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UNIVERSITY OF ALBERTA

HOSPITAL RESOURCE NEED MEASURES:

A Comparison of Diagnosis Related Groups and Nursing Resource Need

by

Michele T. Fryer

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF HEALTH SERVICES ADMINISTRATION

DEPARTMENT OF HEALTH SERVICES ADMINISTRATION

AND COMMUNITY MEDICINE

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled, Hospital Resource Need Measures: A Comparison of Diagnosis Related Groups and Nursing Resource Need submitted by Michele T. Fryer in partial fulfillment of the requirements for the degree of Master of Health Services Administration.

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Date: April 17/90

ABSTRACT

Diminishing resources have put pressure on hospital executives and funding agencies to measure resource need and ensure rational allocation and utilization of resources. Consequently, the Diagnosis Related Group (DRG) patient classification system and the Canadian counter part, Case Mix Groups (CMGs), have become popular tools for reimbursement, planning and decision-making. Although these tools are not currently used for reimbursement of Canadian hospitals, the concept is being studied by some provincial governments.

For nurses, the most contentious issue surrounding use of the DRG for resource allocation is the assumption of constant average daily nursing resource need. The objective of this study is to examine the relationship between DRG weights and nursing resource need, and to evaluate the assumption of constant nursing resource need per day. Descriptive and statistical analyses were performed on 13,591 separations from three, large Alberta teaching hospitals. Frequencies, nursing workload measures and length of stay are provided for all 473 DRGs, and cross hospital comparisons are provided for a sub-set of 16 DRGs. Statistical analysis of the 16 DRGs includes comparison of average daily nursing resource need among selected DRGs, examination of the DRG weight and correlation analysis.

Substantial variation of average nursing resource need per day is shown across DRGs, contradicting the ProPac assumption of homogeneous daily nursing resource need. The ProPac DRG weights show

limited ability to account for variation of nursing resource need among DRGs, and among the three study hospitals. Length of stay, explains less than one half of nursing hour variation per episode. The conclusion drawn is that reimbursement by DRG weight will not fairly allocate resources for nursing services.

Recommendations include a warning against the use of DRGs to represent nursing resource need, and the investigation of a nursing weight for DRGs. Study of the patient and hospital specific variables which affect nursing resource need is suggested.

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CHAPTER I

INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

In the past, hospital funding and reimbursement systems have done little to provide incentives to control hospital expenditures and promote efficient care. Currently, Canadian hospitals are allocated global funds by the provincial governments, which are influenced by previous year's expenditures. Prior to 1983, American hospitals received payment based on their costs. In both countries funding systems have had a tendency to reward hospitals for high service intensity and costs, and failed to provide incentives for cost effective care.

While Americans have made significant changes to their hospital payment system, the funding process for Canadian hospitals remains global for now. New volume based systems are being examined by some of the provinces; for example, the Alberta government has initiated an acute care funding project to develop a formula based on CMGs and severity of illness. In 1983 the American government implemented a prospective hospital payment system based on 473 Diagnosis Related Groups (DRGs), each with a pre-determined weight or relative price. A DRG is assigned a weight of 1.0 when the cost of hospitalization for that DRG is the equivalent of the average cost of all hospitalizations. The Americans use this system to reimburse hospitals for treating the 9.9 million Medicare beneficiaries, and have found it to reduce the rate of increase of Medicare's hospital inpatient

expenditures (ProPac, 1988). The DRG system has become the most widely used system to classify patients by hospital resource need, and some Canadian hospitals use DRGs as a part of internal management information systems to support administrative and funding decisions (Boadway, 1987). For example, The Greater Victoria Hospital Society in British Columbia develops reports for managers which include DRGs; Medisgroups, a severity of illness measure; and nursing patient classification data. This information is available for all separations and is presented to managers in a variety of formats.

Because DRGs are now likely to influence hospital planning and funding in both Canada and the U.S., nursing executives are concerned about how effectively DRGs represent hospital nursing resource need. Variation of hospital nursing resource need is inadequately represented by DRGs according to some authors (Buck, 1986; Halloran & Kiley, 1987; Giovannetti, 1984; Mowry & Korpman, 1984). The weight for each DRG is calculated using the assumption that average daily nursing care costs do not vary across DRGs (Price & Tomaselli, 1988). Nursing care costs are included in the per diem costs for each patient regardless of diagnosis, therefore nursing resource need is assumed to vary only with length of stay. But variation of hospital nursing resource need unrelated to length of stay is well recognized by nurses, so some question arises whether DRG weights accurately reflect hospital nursing resource need. Studies do show large variation of nursing resource need per episode of hospitalization, but few studies have examined the ability of the DRG weights to deal with this variation. Two studies which examined the ability of the

DRG weight to represent nursing resource need at the aggregate level, suggest DRG weights do not need to be modified to reflect nursing resource need (Cromwell & Price, 1988; McKibbin, 1985).

The concept of a set price per episode of hospitalization introduces new financial incentives. In order to prevent hospital costs from exceeding reimbursement, resource consumption per patient will be scrutinized by hospital administrators. Fairness of current reimbursement in the American prospective payment system for Medicare patients is, however, only part of the concern. It is also important to know if the DRG classification system and its weights are appropriate as planning and management tools. Now, more than ever, there is need and opportunity to understand and define nursing resource need of hospitalized patients.

1.2 OBJECTIVES

This study is intended to explore the relationships between DRGs, their weights, and hospital nursing resource need. Specifically, the objectives are:

1. To assess the homogeneity of nursing resource need per day;
2. To examine the ability of the DRG weight to account for nursing resource need of hospital patients;
3. To evaluate the relationships between DRG weights and nursing resource need measures.

1.3 SIGNIFICANCE OF THE STUDY

Demand displaying a stochastic nature makes prediction, assessment and rational allocation of hospital nursing resources difficult, but these processes are imperative in light of current resource constraints. An improved understanding of the patient and hospital specific variables which influence nursing resource need can facilitate appropriate allocation of scarce nursing resources by assisting with objective, accurate assessment and prediction of needs. It appears that the DRG system is now the classification of choice for grouping patients by total hospital resource need, but there is controversy about the appropriateness of the methodology used to represent nursing resources. Literature is available which both supports and refutes the ability of the DRG weight to represent nursing resource need. An analysis of the accuracy with which DRG weights represent the variation of nursing resource need, and the effectiveness of DRGs in producing groups with similar needs for nursing resources will assist in resolving the controversy.

Through the ability to predict, DRGs could improve allocation and effective utilization of hospital nursing resources if they can reasonably represent nursing resource need. If the case mix of a hospital is known, then nursing resource needs could be predicted and planned for. But, factors other than medical classification affect nursing resource use by patient (Talerico & Diers, 1988). Nursing resource use is influenced by physician practice patterns, psychosocial needs of patients, differences in hospital efficiencies and case complexity (Thorpe, 1987).

The importance of understanding the relationship between nursing resource need and DRGs is paramount for two reasons. First, DRGs are now being used for hospital reimbursement and this use may expand; and second, DRGs may represent a potentially valuable planning tool for nurse executives.

1.4 SCOPE AND LIMITATIONS

Data to be used for the study are abstracted from 13,591 patient charts by trained medical records staff, over a two month period. Abstracts are from three large, Alberta teaching hospitals.

It is recognized that large teaching hospitals tend to treat more complex and less common cases than other hospitals. The extent to which the practice patterns of both medicine and nursing will deviate in teaching hospitals from other general hospitals in Alberta, due to the education and research mandate, limits the ability to generalize findings beyond the study hospitals. Thus, the study sample cannot be considered representative of Alberta hospitals or patients. The sample includes patients admitted and discharged between December 1, 1986 and January 31, 1987. This time frame may not be representative of the entire year, due to seasonal variation.

Data used for the study are abstracted from patient charts after separation. Establishing the accuracy of the data used to classify patients into Diagnosis Related Groups is beyond the scope of this study. Research done in the area of reliability of information abstracted from patients' charts has demonstrated a high degree of accuracy of discharge dates, age and sex, but less in

diagnostic and procedure information (Demlo, Campbell & Brown, 1978). Accuracy of DRG classification is also limited by the accuracy of diagnostic and procedural information.

Nursing resource need, a general term, is specifically represented in this study by the Medicus nursing patient classification system measures. The Medicus patient classification tool has several limitations in representing nursing resource need. First, the Medicus classification tool is designed to measure the nursing time required for a group of patients, relative to other groups of patients. The precision is limited to four or five categories. Also, patient needs are only part of requirements for nursing time. Factors influencing nursing care time include practise patterns, support services, physical facilities and skill mix. Therefore, the nursing care hours for the same patient will not be the same among hospitals, or among nursing units.

Although all three study hospitals used the Medicus patient classification tool, two of the hospitals used Medicus' patient classification system with four categories, while the other used the five category system, which limits the ability to compare the hours associated with each category. The degree of reliability and validity of the Medicus patient classification tool used to measure nursing workload may also present some limitations. An audit done during the study period indicated inter-rater reliability can not be assured in some clinical areas for each hospital (Medicus, 1987). Also, nursing resource need, as measured by the Medicus patient classification tool, cannot be directly translated into hours of

nursing care actually provided. The measures recorded are prospective, but documented evidence of the care actually provided is not available. Finally, this study does not attempt to address the quality of care, nor the appropriateness of treatment regimens.

1.5 DEFINITION OF TERMS

Case Mix: A measure to describe the distribution of patients treated in a hospital, which is based on a classification system.

Diagnosis Related Group (DRG): A classification system for hospital separations, used by the American prospective payment system for Medicare patients.

Prospective Payment: A method of hospital reimbursement which provides a predetermined price for each defined category of hospital admission.

DRG Weight (DRGW): A relative measure of resource need for each DRG category in the U.S. prospective payment system. The average of all weights for all patients is defined as 1.0.

Case Mix Group (CMG): A Hospital Medical Records Institute (HMRI) adaptation of the DRG classification system.

Severity of Illness: The degree of illness in a hospital patient as defined by non-diagnostic, patient specific factors.

Nursing Resource Need: A generic term referring to patients' requirements for resources needed to receive interventions and care by nurses.

Nursing Patient Classification: A method of grouping hospital patients into a number of categories, according to perceived requirements for nursing care.

Observational Study: A general term meaning the collection of data by noting events, counting, measuring and recording them. In the present context refers to observing nursing care activities.

Medicus Patient Classification: A factor evaluation nursing patient classification system marketed by the Medicus Corporation. It uses 32 weighted critical indicators of nursing care to group patients into one of four or five types.

Medicus Nursing Management Information System: An information system designed to assist with the allocation of nursing resources within hospitals. Includes patient classification and a staffing methodology.

Nursing Workload Index (WLI) Per Day: The relative measure associated with the Medicus patient type category, for a given day. (see Section 3.3.3)

Nursing Workload Index (WLI) Per Episode: The sum of nursing workload indices for an entire episode of hospital stay by a patient.

Target Hours: The number of direct nursing care hours allocated to each unit of WLI, as defined by each hospital's management.

Nursing Hours (NH) Per Day: Direct nursing hours required per day as defined by WLI per day multiplied by the hospital or unit specific target hours.

Nursing Hours (NH) Per Episode: The sum of NH required for an entire episode of hospital stay by a patient.

Within DRG Variation: Variation of nursing resource need per hospital stay episode within a DRG category.

Between DRG Variation: Variation of average nursing resource need per day across DRG categories.

1.6 FORMAT OF THESIS

A selective review of literature relevant to the thesis is presented in Chapter II. The focus of the literature review is on nursing patient classification systems, case mix measures, and identifying nursing resource need of hospital patients. The research methodology of Chapter III provides a conceptual framework for the study, a description of the data, and the analysis performed. Results of the analysis, consistent with the study objectives are in Chapter IV, and Chapter V concludes the thesis with discussion and recommendations.

CHAPTER II

A SELECTIVE REVIEW OF THE LITERATURE

2.1 INTRODUCTION

The literature review provides an abridgement of the literature which addresses hospital resource need by patient, as it relates to this study. The review will focus on issues relevant to identification of nursing resource need and its relation to total hospital resource need as measured by case mix. The content is organized into three major categories: 1) nursing patient classification systems; 2) case mix measures; and 3) nursing resource need identification.

2.2 NURSING PATIENT CLASSIFICATION SYSTEMS

Patient classification is the process of categorizing patients according to some pre-determined criteria. For centuries hospital patients have been classified by disease, age and sex, but more recently classification systems include acuity of illness and types of care needed (Alward, 1983). Although patient classification is actually a generic term, it is commonly used to describe systems of grouping patients by their resource requirements. In particular, Giovannetti (1978) defines nursing patient classification as:

> Tools used to group or categorize patients into a number of care categories according to the perceived requirements for nursing time.

Nursing patient classification tools were developed in response to the variable nature of the demand by patients for nursing care (Giovannetti, 1978). In the face of variable demands for nursing

care, nursing patient classification tools assist with staffing decisions, budgeting and manpower planning.

Before the 1960's, global standards based on census were generally used to set staffing levels for hospital nursing departments, although there were some attempts made to relate amounts of nursing time required to patient assignment as early as 1947 (Abdellah & Levine, 1979; Giovannetti, 1984). Significant studies which contributed to the development of patient classification systems which group patients according to nursing requirements include:

1. A study, done by the National League of Nursing Education in 1947, resulted in a four category factor evaluation tool for pediatric patients (National League of Nursing Education, 1947);
2. A study done by Marion Wright in 1954 at Harper Hospital in Detroit resulted in a three point severity of illness scale related to nursing treatments and procedures (Wright, 1954);
3. A staffing tool was developed in 1955 by the American Army Medical Service. The tool started as a nine category patient classification system and was later refined to eight categories. The four indicators used to classify patients were nursing procedures, physical restriction, instructional needs and emotional needs. Time studies were used to identify quantities of nursing time for the categories (Claussen, 1955);

4. The American Army Medical Patient Classification System was re-organized in 1955 by H.G. Tibbits. An expansion of the indicators used to classify patients resulted in a more objective system which examined broader areas of patient care (Abdellah & Levine, 1979);

5. The work of Tibbits was further developed by the U.S. Public Health Service in 1957. This was the first study to assign point values, or weights to the patient care categories (Abdellah & Levine, 1979);

6. A 1957 project called Progressive Patient Care at Manchester Memorial in Connecticut developed six levels of patient care using 16 specific indicators. The system was geared at organizing services around patient needs (Jelinik & Dennis, 1976);

7. In 1960, the classification method, deemed the strongest to that date in terms of reliability and validity, was developed at Johns Hopkins Hospital. The system grouped patients into three levels according to needs for nursing care. The Johns Hopkins' method was one of the first to provide estimates of nursing time which could be translated into workload (Flagle, 1960).

The above studies led to further work by Connor (1961) which showed quantitatively that patient census was not a good indication of nursing workload. Work sampling and an index of direct care load were used to investigate variation in nursing workload. Connor's

work was to be the base for all future developments in nursing patient classification systems (Giovannetti, 1984).

The Medicus patient classification system was developed at Rush-Presbyterian-St. Luke's Medical Center in 1971. Based on Connor's work (1961), the system established categories in terms of nursing hours and then developed indicators for classification. The indicators were weighted using work sampling and professional consultation.

A 1978 estimate by Giovannetti revealed that approximately 1000 American hospitals were using a patient classification system for nurses' staffing. Since that time both the U.S. Joint Commission for Hospital Accreditation and the Canadian Council on Hospital Accreditation have supported the use of patient classification instruments (Canadian Council on Hospital Accreditation, 1986). Therefore, it is estimated that the majority of hospitals in North America are using nursing patient classification systems.

Two types of instruments designed to classify patients according to nursing resource need are common in the nursing field. These are prototype and factor evaluation (Abdellah & Levine, 1979, Reitz, 1985). Both types are based on patient characteristics found to have a high correlation with direct nursing time required and use categories which are ordinal and mutually exclusive.

The prototype evaluation instrument involves broad descriptions of a "typical" patient for each category. A list of nursing activities and a descriptive paragraph may be associated with each category. Based on a nurse's professional judgement, patients are

placed in the category most closely matching their own characteristics.

The design of factor evaluation instrument is different from prototype patient classification in that a number of critical indicators which describe direct care are rated individually (Giovannetti, 1979). The critical indicators are weighted according to required nursing time and the resulting sum is used to categorize each patient in a care level. In both prototype and factor evaluation instruments each category is assigned a weight which may be relative, or may define the nursing time required. The weight is derived using work sampling studies and will vary between hospitals. The weights are relative only and do not represent an absolute need for nursing care. It is recognized that many factors will affect the weight assignment during the observational study, and that these factors will change over time and place. Some examples of influencing factors are: 1) current availability of nursing staff; 2) the skill and ability of nursing staff; 3) effectiveness of leadership and the nursing team; 4) physical facilities; 5) support services; 6) physician practices; and 7) philosophy and standards of the nursing department (Giovannetti, 1984; Jelinik & Dennis, 1976; Petit, Kavois & Glandon, 1988).

The purpose of any nursing patient classification tool is to measure nursing time required (Giovannetti, 1979). The most common application is the allocation of staff in order to match perceived patient needs with available nursing resources (Alward, 1983). Alward also suggests that patient classification data may be used as

a measure of efficiency; however, Giovannetti (1988) states this is one of the most common misuses. Giovannetti points out that hours of nursing care per patient day are inadequate to explain productivity, as effectiveness of care is not taken into account.

Data derived from patient classification have also been used to set a price for nursing service rendered (Curtin, 1983; Ethridge, 1985; McClain & Selhar, 1984). Giovannetti (1988) states that the use of patient classification systems to represent cost has limitations. The data can be useful to monitor and control but the exclusion of the skill level of care providers, and lack of evidence that care required is actually provided makes patient classification a limited indicator of cost. Research does support, however, that patients, on average, receive the amount of care prescribed by their classification, under conditions of adequate staffing (Giovannetti, 1979; Halloran & Kiley, 1984).

Patient classification data are used currently as information for management decisions by hospital administrators. For example, Women's College Hospital in Toronto uses Medicus Nursing patient classification data and the Hospital Medical Records Institute (HMRI) abstracting system for reporting and predicting total workload for individual and groups of patients (Medicus Network, 1987). Several authors suggest that patient classification data are useful in planning and substantiating hospital nursing budgets (Grohar, 1986; Mowry & Korpman, 1985; Sovie, Tarcinale, Vanputtee & Stunden, 1985).

Like all measurement tools, reliability and validity are essential if some purpose is to be served (Giovannetti, 1988). A

tool is reliable if results can be replicated with consistency. While reliability can refer to stability, homogeneity or equivalence, equivalence is the most important measure for patient classification tools (Giovannetti, 1979). Equivalence is the extent to which consistent results are produced when the same tool is applied to the same patient by different observers. This type of equivalence is referred to as inter-rater reliability. Giovannetti (1979) recommends inter-rater reliability of a patient classification instrument be achieved at three levels. All nurses on the same nursing unit using the tool should be classifying patients the same way; nursing units within a hospital should be using the tool the same way, and finally, institutions should be using the tool in the same way. There has been little inter-rater reliability testing done between hospitals, which limits comparability of data even when the same tool is used. A level of 90% agreement is normally viewed as acceptable for inter-rater reliability (Giovannetti & Mayer, 1984).

A patient classification tool is valid if it measures what it was actually designed to measure. While a nursing patient classification tool cannot actually measure patients' needs for nursing care, the purpose of a factor evaluation tool is to group patients according to perceived requirements for nursing time. For this purpose, validity can be demonstrated. As the most common use of nursing patient classification systems is to predict nursing time requirements, predictive validity is essential. The process of achieving predictive validity of a factor evaluation nursing patient classification system involves three phases.

First, the critical indicators need to be representative of the property being measured, or the patients' need for nursing time. There are elements of both content and construct validity in this phase. Content validity consists of professional judgement, and has been commonly reported for nursing patient classification systems (Giovannetti, 1979). Construct validity involves empirical study which supports the underlying theoretical construct of a particular measure. Factor analysis is the statistical method used to demonstrate construct validity. The next phase is the validity of the resulting categories, and their associated weights. The validity of categories hinges on their ability to produce groups of patients who differ significantly in their requirements for nursing time. Observational studies which measure actual nursing time provided to patients in each of the categories provides the information needed to validate the categories.

The third phase to consider validity of a factor evaluation nursing patient classification system is the hours associated with each category. The hours will reflect not only the patients' needs for nursing time, but factors in the work environment which influence time required to meet patient needs. The efficiency of the facility, the supports, and the requirements for tasks not related to direct patient care will all influence the hours required. These hours are determined and validated by observational studies, and therefore, will not be the same per nursing unit, or per hospital.

Nursing patient classification systems are criticized for lack of concurrent validity, which is comparison of one instrument with

another. The hospital specific measures involved in development and implementation of the tools makes it difficult to accept a classification system as valid in multiple settings (Giovannetti, 1979 & O'Brien, 1987).

2.2.1 Medicus Patient Classification Tool

The Medicus patient classification tool is a factor evaluation system, with four or five categories. It was developed by the Medicus Corporation with the Rush-Presbyterian St. Luke's Medical Center. The tool contains 32 critical indicators which were selected based on regression and factor analysis. Each critical indicator is weighted according to professional nursing input and the findings of work sampling studies (Robinson, R., Personal Communication, October 11, 1988). In that the results of work sampling studies used are affected by the current availability of nursing resources, the weight assigned to the critical indicators is dependent on the site and time of the study. As the point values and actual procedures for determining them are not available to the public, the system can only be implemented with the assistance of Medicus corporation.

Nursing staff identify those critical indicators which are appropriate for each patient; the point values per patient are totalled, and then according to pre-determined ranges, the patient is placed in one of four or five categories. Each category has target hours per 24-hour period, which were assigned by nursing administration, taking into consideration available budget, historical patterns and subjective assessments.

2.2.2 Summary

Patient classification tools provide a measure of nursing time requirements which have proven useful for managing hospital nursing resources. Most North American hospitals are now using patient classification systems for staffing, budgeting, decision making, and more recently, costing. The current issues surrounding the use of patient classification tools include the following:

1. The changing nature of nursing practice may not be adequately represented in previously developed tools;
2. There is no evidence that appropriate allocation of nursing hours has a direct relationship with quality of care;
3. Patient classification tools are of little use without ongoing evidence of reliability and validity;
4. Patient care categories are based on average care times required and do not provide actual time needed or used;
5. Average care times do not differentiate between levels of skill and competency;
6. Hours of nursing care is an inadequate measure of productivity as it ignores effectiveness;
7. Patient classification systems are adapted to each hospital, making cross-hospital comparison difficult.

2.3 CASE MIX MEASURES

Case mix generally refers to the mixture of patients which a hospital treats. Case types, a form of patient classification, are

defined by a particular variable, such as disease, length of stay, cost, or resource consumption to classify hospital separations (Jones, 1984). Patients have been classified by medical diagnosis, prognosis, treatment regimens, organ systems, patient characteristics, and utilization of resources. Purposes of case mix measures include evaluation of performance, utilization review, resource allocation, planning, research and reimbursement.

The DRG classification system is the most well known case mix measurement system. Plowman and Shaffer (1984) describe other classification systems such as the ICD-9-CM (International Classification of Diseases-9th Revision, Clinical Modification); Disease Staging; Severity of Illness Categories; and Patient Management Paths.

Hornbrook (1982) suggests that the ideal case mix measure must be valid, reliable, and compatible with the purpose for which it is developed. Other desirable qualities of case mix measures outlined by Hornbrook include sensitivity, cost-effectiveness, and acceptability. Further strengths and limitations of currently available case mix measures will be discussed in the following sections.

2.3.1 ICD-9-CM Disease Classification

The International Statistical Institute in Vienna headed by Jacques Bertillion in 1891 originally prepared International classification of diseases causing death. The most recent revision is the ninth, and includes a clinical modification. A tenth revision

is currently under way through the World Health Organization (Levine & Abdellah, 1984).

The International Classification of Disease, Clinical Modification or ICD-9-CM, is a five digit coding scheme which classifies morbidity and mortality information (Hornbrook, 1982). Data used for classification includes etiology, symptoms, procedures and sites of involvement. Canadian hospitals, except those in Alberta, use a four digit version of this disease classification scheme called ICD-9 (Boadway & Brown, 1987; Stuart, 1986). All Alberta hospitals use the ICD-9-CM classification system.

The ICD-9-CM provides a universal system for statistics, reporting, indexing and storage of mortality and morbidity information, but is limited by the variety of conditions which fall into one sub-category. For example, it is within the coding conventions to code a diagnosis of "rule out" or "suspected" disease as presence of the disease, when the disease may, in fact, not be present. The incidence of that disease will appear more prevalent than it actually is (Mullen, 1985).

2.3.2 Diagnosis Related Groups

The majority of the literature on case mix classification schemes to date focuses on the Diagnosis Related Groups (DRGs) of the United States. For each hospital separation, a DRG code is assigned by classifying the patient into a group with similar medical diagnosis and like needs for total hospital resources.

Before the introduction of the DRG prospective payment system, reimbursement to hospitals for the U.S. Medicare patients was based on a per diem basis, and the costs were escalating at an alarming rate (Shaffer, 1984). Work by Feldstein (1965) demonstrated case mix was significant in explaining variations in hospital cost and the research focus shifted to case mix. In the mid 1970's research at Yale University by Fetter and his associates (1980) resulted in the development of the initial DRGs. The purpose of DRGs was originally to evaluate, compare and provide feedback about hospital performance (Fetter et al., 1980).

The initial version of DRGs, which used the ICDA 8 classification system, had 83 major diagnostic categories and 383 DRGs. Some problems with the original system were identified as:

1. There was a potential for coding and classification errors as the data used to classify were abstracted from the medical record;
2. The system reflects the methods of practice at the time of development and ongoing revision would be required;
3. Surgical procedures resulted in an increased reimbursement, providing an incentive to operate;
4. Categories were developed to be homogeneous as to length of stay rather than cost of treatment;
5. DRGs were criticized for their lack of homogeneity with respect to severity of illness and stage of disease;
6. Age categories were not defined sharply enough;

7. The relevance of the system may have been limited to the population tested.

The inadequacy of length of stay in reflecting costs was recognized by the researchers, but the unavailability of true cost data led to the role of length of stay in defining the initial DRG weights (Plowman & Shaffer, 1984).

The current version of DRG classification involves an initial grouping of the 10,000 ICD-9-CM disease codes into 23 major diagnostic categories (MDC) by organ system. The next classification step is based on the presence or absence of surgical intervention, followed by specific procedures or diagnoses involved, average length of stay, age and presence of complications (Boadway & Brown, 1987; Zuckerman, 1983). The intended result is the classification of hospital patients into medically meaningful groups with like needs for total hospital resources. The development of second generation DRGs in 1979 included the following changes:

1. A national cost data base was used;
2. The MDCs were more closely aligned to medical specialty;
3. Accommodation was made for outliers;
4. Age became a more significant variable;
5. Physician opinion became more influential in development of the categories;
6. Surgery was redefined as presence in the operating room;
7. The number of DRGs was increased to 467 (Shaffer, 1984).
8. The "second generation" DRGs were developed with actual cost data instead of average length of stay. Classifi-

cation in both versions relied on statistical techniques to identify patients with similar lengths of stay or cost, and compatible diagnoses (Coffey & Goldfarb, 1986).

The Tax Equity and Fiscal Responsibility Act (TEFRA), which called for prospective payment to hospitals, was passed in the U.S. in 1983, and resulted in the DRG prospective payment system for all Medicare and some state's Medicaid patients (Shaffer, 1984). For the purpose of reimbursement, each DRG has been assigned a weight or relative cost based on average charge for treatment of a patient in that DRG category (Botz, 1985). The average weight for all U.S. separations is defined as 1.0.

The reimbursement provided by the prospective payment system is intended to reflect the relative costliness of a DRG. To arrive at the reimbursement figure, the DRG weight is multiplied by a standardized payment adjusted for area wages and the teaching status of the hospital (Price & Tomaselli, 1988).

The objective of prospective reimbursement by DRG was clearly to reduce Medicare's outlay for inpatient care, while maintaining an acceptable level of quality and access. While this describes the long-term goal, there has been and will continue to be profound side effects on the American health care system. The financial incentives provided by a per case prospective reimbursement system have shifted the focus in the hospital from process to outcome (Levine & Abdellah, 1984). The most evident change supported by empirical data after the American implementation of the prospective payment system is a decreased length of stay (ProPac, 1988). Other effects are reported

but not necessarily statistically supported. Generally, the effects are reported to be a result of attempts by hospitals to reduce costs per case, such as decreased ratio of personnel to patients, the provision of more services before and after admission and decreased discretionary activities such as research and education. Other reported tactics include admission of "healthier" patients and an increase in external transfers of patients who may represent a financial burden.

Changes in frequency of particular profitable DRGs has been reported, and has been described as "DRG creep" (Hellinger, 1985). Computer software is now being marketed to select the DRG with the highest level of reimbursement when a patient could potentially be in more than one DRG category (Stuart, 1986).

2.3.4 Case Mix Groups (CMGs)

The Hospital Medical Records Institute (HMRI), a Canadian medical records abstracting service, has developed a DRG-type case mix classification system called Case Mix Groups (CMGs). It is not a reimbursement system, but may provide needed management information for hospitals. CMGs are reported to be useful to determine relative cost implications of case mix changes, and to establish standards as a measure of efficiency. The CMGs may also facilitate logical, systematic communication with management, physicians and government. CMGs are an adaptation of the DRG system, with the following differences:

1. CMGs use the ICD-9 disease coding system to collect data, rather than the ICD-9-CM coding system used by the DRG system;
2. CMGs use the most responsible diagnosis for classification rather than the admission diagnosis used by the DRG system;
3. Deaths are excluded from Canadian case weights; and
4. CMG classification allows for differentiation of managed and unmanaged conditions (Carmichael, 1988).

The algorithm for grouping of patients into CMGs is similar to DRGs, and therefore the limitations described for the DRGs are also limitations of CMGs. A study done by Botz (1985) examined analogous disease groups of the CMG and DRG systems, and found their average lengths of stay to have a correlation coefficient of .96. This study suggests the compatability of the two classification systems. The CMG System, however, does not include its own relative weights.

Recognizing a weighting system based on Canadian data would be relevant to Canadian hospitals, HMRI has since developed a hybrid weighting system for the CMGs. HMRI combined New York State relative cost weights and HMRI length of stay weights. The New York State relative cost weights were derived using a cost finding method, resulting in an average total cost for each DRG category. A sample of 840,000 cases from 22 New York hospitals provided the data base. The cost finding methodology involved 27 cost elements. Nursing weights were established by a nursing panel, as they were found to differentiate DRGs (Carmichael, 1988).

The HMRI length of stay weight is a measure of bed utilization, but does not reflect severity of illness, or the relative cost of patient days. The weight is calculated for each CMG by dividing the average length of stay for each CMG by the HMRI data base average length of stay. Thus, it is a measure of relative length of stay.

$$\text{CMG relative weight} = \frac{\text{CMG average LOS}}{\text{data base average LOS}}$$

(Carmichael, 1988)

The hybrid weight per CMG is the New York State per day relative weight, multiplied by the HMRI relative length of stay weight. The hybrid weight is intended to reflect average resource consumption per case. However, fundamental problems may result in the HMRI weights actually being less representative of Canadian hospital costs than the American DRG weights (Botz, 1989). Botz states that in the absence of Canadian cost data, the unnecessarily complex formula which produces the HMRI weights, relies on congruent average-lengths-of-stays in the CMG and DRG systems. Paradoxically, it is when lengths-of-stay differ between U.S. and Canada, that the formula results in a different weight. Botz argues that due to this inconsistency, American DRG weights may be more appropriate than HMRI weights for Canadian hospitals to use for case mix analysis and fiscal planning.

2.4 IDENTIFYING NURSING RESOURCE NEED

Most concerned parties now agree that the traditional per diem allocation statistic is not the most appropriate method of measuring nursing resource need of hospitalized patients due to variation of both medical and non-medical patient needs (Caterinicchio, 1984; Prescott, 1986; Reitz, 1985). Medical characteristics such as disease, treatment regimens, and complications will affect nursing resource needs, as will the patient's individual response to the illness and its treatment. For example, some patients will need more support, teaching and supervision than others.

Earlier literature on the topic of case mix costing supported a flat per diem rate for nursing services, but the assumptions used in this approach have since lost strength. Thompson, one of the developers of the DRG system, suggests that certain nursing care problems will have a high probability of occurring within selected medical diagnosis. An incidental finding of a study done by Thompson in 1968 suggested that hospitals varied greatly in their hours of nursing care per patient day. It was not until 1976, however, that the difference in hours of nursing per patient day was again examined. A study done at Yale University used a nursing patient classification instrument to find the daily demands for nursing care vary significantly depending on the DRG treated (Social Security Administration, 1976). Due to limitations in available data, this issue was not resolved when the DRG prospective payment system was implemented in 1983. Therefore, inherent in the DRG prospective

payment system, is the assumption that average daily nursing costs are constant (Price & Tomaselli, 1988).

Concern that nursing resource use was not adequately reflected in the DRG system led to the Relative Intensity Measure (RIM) study. The 1981 study is based on a sample of 2,260 patients from eight New Jersey hospitals. Initially patients were classified into Major Diagnostic Categories (MDCs) of the DRG system and, using statistical procedures, they were further classified into 13 Nursing Resource Clusters (NRCs). Each NRC was assigned a Relative Intensity Measure (RIM) to reflect the relative amount of nursing time required (Caterinicchio, 1984). The RIM study concluded that length of stay was the most powerful predictor of nursing resource use and explained 94 percent of nursing workload variation. Thus, the RIM study tends to support the DRG developers assumptions of a constant average nursing resource need per day. However, the RIM study must be viewed in light of some significant limitations. The small sample was not a probability sample and as the data were from eight New Jersey hospitals, the generalizability of the finding is limited. Also, the method of determining weights for the nursing resource clusters limits the value of the RIM study. Attempts to alleviate problems with variation of nursing skill mix included a conversion of actual minutes to standardized minutes. The conversion is based on hourly wages of care providers, which do not necessarily reflect relative differences in minutes of nursing care by the various providers.

Later studies, which show DRGs contain patients with heterogeneous nursing resource need refuelled the concern that prompted the

RIM study (Green, McClure, Wintfeld, Birdsall & Rieder, 1988). Studies which used nursing patient classification systems to represent nursing resource need conclude there is significant variation of nursing resource need within DRGs, and that some DRGs show more variability than others (Atwood, Hinshaw & Chance, 1986; Buck, 1986; Giovannetti, 1984; McClain & Selhar, 1984; Miller, Welches & Walker, 1984; Mowry & Korpman, 1985; Nyberg & Miller, 1984; Sovie, Tarcinale, VanPuttee & Stunden, 1985). Although different studies examined the same DRGs, no pattern of particularly variable DRGs was revealed. A recent study by Talerico and Diers (1988) based on existing data from a number of U.S. hospitals, identified patients whose requirements for nursing care and length of stay were extreme. They found the outliers to be in specific age groups, and to be emergency admissions. These factors may introduce systematic bias into the variation of nursing resource need, and would be problematic if they are not accounted for by DRG weights.

The studies described to this point examine nursing resource need per episode of hospitalization, but have not examined the ability of the DRG weight to represent nursing resource need. For this reason, their conclusion that the demonstrated variability suggests inaccuracies in the DRG prospective payment system, is weakened. Variation of nursing resource need within DRGs is expected as some patients will need more than average, and others less. But, at the aggregate level, the extremes of nursing resource need are expected theoretically to cancel out each other and the mean will be the appropriate measure. Therefore, variation of nursing resource

requirements will only be a problem to the extent that systematic bias is present.

Since the implementation of the DRG based prospective payment system in the U.S., the Prospective Payment Assessment Commission (ProPac) has studied the issue of nursing and the DRG weights (Price & Tomaselli, 1988). In 1987, a technical advisory committee convened to assess findings from major studies in the area, and agreed that evidence suggests nursing intensity per day varies across DRG, but the implications for DRG weights was unclear. ProPac then funded an analysis of existing data to determine the effects of applying a nursing intensity weight on the DRG weights (Cromwell & Price, 1988). ProPac researchers used the Fetter and Thompson (1987) study to identify weights for routine nursing care, and the Sovie et al. (1984) study to identify nursing weights for intensive care unit weights for nursing. They found the average DRG cost share would change very little as a result of a nursing adjustment. This finding supports an earlier study by McKibbin (1985) which suggests that for the 20 DRGs studied, DRG weight generally reflects variation of nursing resource need. He did, however, suggest the existing variation of nursing resource need warrants further study, A study done at Yale University by Fetter and Thompson (1987) derived a nursing allocation statistic, or nursing weight for each DRG, and also found it did not increase the precision of the cost finding process. Fetter recommended further study, particularly on high volume, nursing intense DRGs, and pediatric DRGs which were found to require more nursing time than previously documented.

Although ProPac's study did not recommend an adjustment of the DRG weight to reflect nursing intensity, the researchers recognized the need to isolate, define and understand nursing resource need for the purpose of control and management (Price & Tomaselli, 1988). A better understanding of the differences among the various nursing patient classification systems is also strongly recommended (Cromwell & Price, 1988; Fetter, 1987; Price & Tomaselli, 1987).

Nursing patient classification systems have been used to assign a nursing care cost or price to each DRG category. For example, average nursing hours per DRG have been multiplied by hourly wage rates to produce a measure of cost (Fosbinder, 1986; Giovannetti, 1984; Grohar, 1986; McClain & Selhar, 1984; Mitchell et al., 1984). Some hospitals have implemented variable billing based on average cost per DRG (Ballard, Barach & Cullen, 1985).

Methodological limitations as well as differences in conceptual frameworks make it difficult to compare studies which use patient classification systems to measure nursing care cost per DRG. The problems include:

1. Reliability and validity of the nursing patient classification system;
2. Differences in the definition of direct and indirect nursing care;
3. Inconsistency in the inclusion/exclusion of intensive care unit nursing;
4. Inconsistency in the inclusion/exclusion of DRG system defined outliers;

5. Lack of consideration for skill mix; and
6. The fact that nursing care needed is not necessarily nursing care provided.

An assumption, stated frequently in the literature, is that direct nursing care represents 30-60 percent of the total cost of treating a patient (Riley & Schaefers, 1983). Several studies, however, have used nursing patient classification systems to show direct nursing care constitutes less than 20 percent of the total cost (Bargagliotti & Smith, 1985; Grimaldi & Micheletti, 1982; Mowry & Korpman, 1985; Riley & Schaefers, 1983). Giovannetti (1984) also demonstrated that the proportion of nursing care costs to total costs varies across DRG categories.

Studies have examined both nursing patient classification systems and the DRG system for their ability to predict hospital costs (Atwood et al., 1986; Fetter, 1987; Halloran, 1985; Scherubel & Swartz, 1988). Halloran (1985) used regression analysis to show that nursing condition, as defined by nursing diagnosis, explained twice the variation in nursing workload (52.4%) than medical condition as defined by DRG (26.3%). Forty percent of nursing workload remained unexplained. Several other authors claim nursing patient classification can increase the ability to predict nursing resource use over DRGs. Harrell (1985) showed that in a study of 15 DRGs, length of stay is the most powerful predictor of nursing workload, explaining 78.5 percent of the variation. She suggests that measures based on nursing patient classification results can contribute an additional 10 percent explained nursing workload variation. Lucke and Lucke

(1986) provided a model which showed that 54.2 percent of the variation of total hospital costs is explained by length of stay, Horn's severity of Illness Index, and nursing patient classification scores. Severity of illness is identified by Horn (1983) as being able to explain 40-50 percent of the variability of total hospital charges, while DRG explained much less. Several studies show a correlation between nursing patient classification scores and severity of illness measures (Halloran, 1985; Lucke & Lucke, 1986; Reitz, 1985). This suggests that nursing patient classification and some severity of illness indices contain common classification criteria.

2.5 SUMMARY OF THE LITERATURE

Case mix is used as a measure of hospital output to evaluate performance, assess utilization and allocate resources (Hornbrook, 1982). Due to the 1983 implementation of the Diagnosis Related Group (DRG) prospective payment system by the American government, the DRG system is the most well known case mix system (Plowman & Shaffer, 1984). The DRG case mix system is used to prospectively reimburse hospitals for treating Medicare patients and consists of 473 categories with a weight or relative price attached to each category.

The literature reflects concern about the method used in the DRG system for dealing with nursing resource need (Brodie & Kay, 1985; Lucke & Lucke, 1986; Wolfe & Lesic, 1986). Due to incomplete nursing cost data, average nursing resource costs per day are

assumed constant (Price & Tomaselli, 1988). If the average nursing intensity per day varies significantly across DRGs, then DRG weights may be inaccurate. As the variability and stochastic nature of hospital nursing workload has been accepted by health service researchers, the concept of constant daily nursing resource need has been challenged.

Nursing patient classification systems were developed in response to the variable nature of hospital patient's demand for nursing care, and have been used for staffing decisions, manpower planning, budgeting and more recently, costing and pricing of nursing care. Nursing patient classification systems have been used since 1947 (Abdellah & Levine, 1979). Their development to date has been influenced by many studies, but perhaps most significantly by Connor (1961) who empirically demonstrated that patient census was not a good measure of nursing workload (Giovannetti, 1984). Since American and Canadian hospital accreditation bodies have encouraged the use of nursing patient classification systems, their use has become widespread.

Researchers who use nursing patient classification systems to represent nursing resource need indicate that there is significant variation of nursing resource need within and between DRGs (Atwood, Hinshaw & Chance, 1986; Buck, 1986; Giovannetti, 1984; Mowry & Korpman, 1985). These studies suggest that the constant per diem allocation statistic for nursing, used by the DRG prospective payment system, is inaccurate. However, controversy is evident in the literature. Cromwell and Price (1987) have shown that a nursing

intensity weight combined with the DRG weight would have minimal effect on reimbursement, and have concluded that the constant per diem nursing weight is appropriate.

All studies suggest that further research into the factors which effect nursing resource need of hospitalized patients is critical to improve understanding of costs not only for the purpose of reimbursement, but also for control and management. The relationships between DRGs, DRG weights and nursing resource need are not yet clear.

The following summary of relevant studies demonstrates the need for further study of the relationship between nursing intensity and DRGs.

1. Significant variation of nursing workload measures within and between DRGs has been repeatedly demonstrated, but the implications of the variation are not well discussed (Adams & Johnson, 1986; Bargagliotti & Smith, 1985; Fosbinder, 1986; Giovannetti, 1984; Green, McClure, Wintfeld, Birdsall & Rieder, 1988; Mitchell, Miller, Welches & Walker, 1984; Mowry & Korpman, 1985; Petit, Kavois & Glandon, 1988; Sovie, 1985).
2. Coefficient of variation for nursing workload measures by DRG indicate that some DRGs have larger variation in nursing workload than others (Curtin, 1983; Fosbinder, 1986; Giovannetti, 1984; Prescott, 1986; Reschak, 1985; Richards, Hexum & Anderson, 1987; Sovie, Tarcinale & Van Puttee, 1985).

3. A combination of nursing workload measures produced by patient classification systems and DRG weights, when used as independent variables in regression analyses have explained more variation of average cost of hospitalization than DRG weights alone (Caterinicchio, 1984; Halloran, 1985; Harrell, 1986; McKibbin, 1985; Trofino, 1986).

4. The estimated portion of average hospital cost attributed to nursing wages is about 14-40%, depending on the study (Bargagliotti & Smith, 1985; Grimaldi & Micheletti, 1982; LeFevre, 1985; McKibbin, 1985; Mitchell et al., 1984; Mowry & Korpman, 1985).

5. It has been reported that the portion of average hospitalization cost represented by nursing wages varies significantly across DRG categories (Giovannetti, 1984).

6. Some studies have suggested that DRG weights adequately account for variation in nursing costs (Fetter & Thompson, 1987; Grohar, Myers & McSweeney, 1986; McKibbin, 1985; Price & Tomaselli, 1988).

CHAPTER III

RESEARCH METHODOLOGY

3.1 CONCEPTUAL FRAMEWORK - RESOURCE NEED MODEL

DRG developers classified hospital separations according to medical diagnosis and resource requirements. An assumption was made that average nursing resource need for each DRG category is proportional to average length of stay.

One of the primary reasons patients require hospitalization is their need for professional nursing care, and the variability of nursing care requirements per patient is well recognized by the nursing profession (Connor, 1961; Giovannetti, 1979). In response to the variability, nursing patient classification tools such as the Medicus system are used within many hospitals to plan and allocate nursing staff for groups of patients. There are fundamental differences in the resource need assessment employed by the DRG system and nursing oriented patient classification tools, such as the Medicus system, but as every patient consumes some nursing resources each day he is in hospital, it is logical to assume there is a relationship between the two measures.

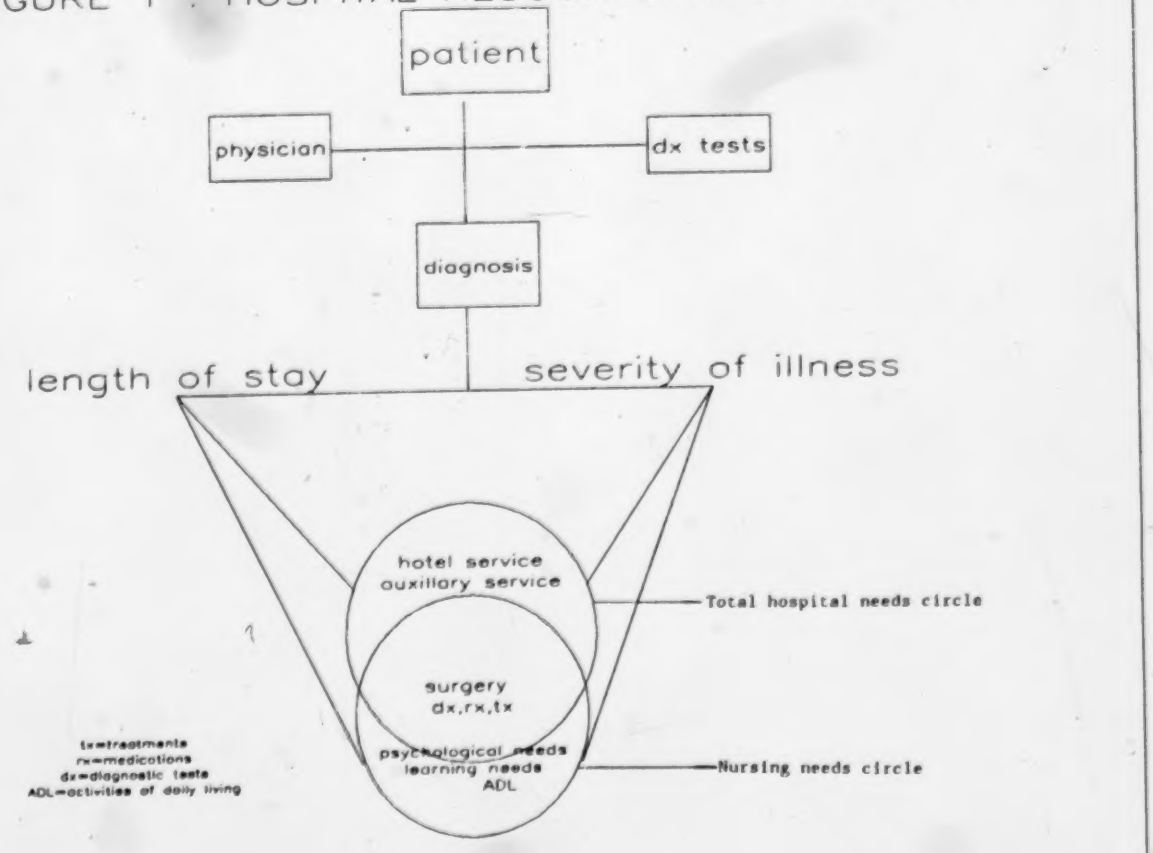
Figure 1 schematically depicts the relationships between factors which influence the resources needed by a hospitalized patient. Patients are identified for hospital admission by their physicians, who define the need and provide an admission diagnosis. The patient's severity of illness may or may not be known on admission, and changes throughout the hospital stay. Severity of

illness affects length of stay, total resource need and nursing resource need.

The patient specific factors in the overlapping section of the circles are those which affect nursing resource need, and other hospital resource needs. These factors may include surgery, treatment, diagnostic tests, procedures and medication. The factors contained only in the nursing resource need circle are thought to significantly affect only nursing resource need, and conversely those factors appearing only in the DRG based resource need circle are thought not to significantly affect nursing resource need. Activities of daily living, psychological and learning needs are presumed to affect predominantly nursing resource needs, while the needs for auxiliary and hotel services are not.

In this study, nursing resource need is represented by the Medicus workload measure, and the total resource need by DRG weight. The area of study becomes the overlapping section which represents the degree to which the case mix measures explains variation in nursing resource need.

FIGURE 1 : HOSPITAL RESOURCE NEED MODEL



3.2 RESEARCH STRATEGY

The primary purpose of this study is to explore the relationships between DRGs, DRG weights, and nursing resource need as measured by a patient classification system. To this end, the research is divided into three phases: 1) descriptive analysis; 2) analysis of nursing resource need per episode, per day, and per DRG weight unit; and 3) evaluation of relationships between DRG weight and nursing resource need measures. In order to meet the research objectives, the primary focus is on nursing resource need per day and per DRG weight unit; and the evaluation of the DRG system's assumption of homogeneous daily nursing resource need.

3.3 THE DATA

3.3.1 The Source

The data were obtained from Alberta Department of Hospitals and Medical Care (DHMC) and are part of a study initiated in 1986, which proposed to compare Medicus patient classification data with DRGs. Three large, Alberta teaching hospitals agreed to participate, and funding was provided by DHMC. Daily patient classification was conducted by all nursing units, for all inpatients, using the Medicus Nursing Management Information System. The results were sent daily to the medical records departments of the study hospitals where the nursing resource measures were processed and included with the separation abstracts. Although the DRG system does differentiate nursing resource need in intensive care units from general wards, the study data do not identify intensive care unit patient days.

Each of the study hospitals assigned a coordinator in their medical records department, who trained personnel involved in the abstracting, and performed an audit to assess the accuracy of abstracting and coding. Medicus corporation was contracted by DHMC to conduct an audit of the patient classification system. The objectives of the audit were to determine the reliability of patient classification results within each hospital; and to assess between hospital differences in use of the tool (Medicus, 1987). Some concern about the reliability was identified in each hospital, and significant differences in the application of the Medicus tool were identified; introducing limitations for cross-hospital comparisons. The researcher had no involvement in the data collection.

3.3.2 Nature of the Data

Data were collected in three hospitals between November 3, 1986 and February 3, 1987; but the sample used in this research consists of separations with admission and discharge occurring between December 1, 1986 and January 31, 1987. Data outside the specified 61 day period is excluded in order to deal with the problem of missing data at the beginning and end of the collection period. The data file contains 13,591 separations.

The study hospitals are large, urban, teaching hospitals. Their bed numbers range from 957 to 1,346 and all have approximately 30,000 or more admissions annually. The average annual budget for the three study hospitals is 133 million dollars. With the exception of hospital 1, which does not have a pediatric service, all special-

ties are provided in the study hospitals. In hospital 3, only physicians with a specialty have admission privileges. Because of the high degree of specialization within the study hospitals, patients with complex problems are referred from community and rural hospitals from all parts of Alberta and for hospitals 2 and 3, Northwest Territories. The patient population included in the study is not typical of all Alberta hospitals, and not likely representative of all Alberta hospitals.

3.3.3 Description of the variables

The data elements recorded for each separation include: 1) age in years; 2) sex; 3) length of stay in days; 4) hospital code of 1, 2 or 3; 5) DRG code (1 to 473); and 6) nursing resource need measures. The DRG weight for 1987 obtained from the U.S. Prospective Payment Commission, was added to each separation record. The nursing resource need measures are nursing workload index and direct nursing hours per day, and per episode; as defined by the Medicus Nursing Management Information System.

The Medicus nursing workload index is a relative value assigned to each of the categories of patient type. The associated relative values, or workload index, for each patient type are as follows:

Type	WLI hospital 1	WLI hospital 2	WLI hospital 3
1	0.5	0.5	0.5
2	1.0	1.0	1.0
3	2.3	2.5	2.5
4	3.8	5.0	5.0
5	5.5	n/a	n/a

Daily, each patient was classified into one of four or five types, and the resulting workload index was recorded. On separation, the sum of each day's workload index was documented, and this became the WLI per episode. Nursing hours (NH) are a result of the workload index, multiplied by the target nursing hours per unit of workload index, for that nursing unit. As discussed in the literature review, the target hours vary by nursing unit and by hospital. For example, if the target hours set for a particular unit is 3 then a type 1 patient will be assigned 1.5 hours, and a type 2 patient will be assigned 3 hours. The sum of all daily nursing hour measures was documented for each separation.

3.4 ANALYSIS

3.4.1 Description of sample

The distribution of the 13,591 separations is described by hospital, sex, age group, and length of stay. Not all of the 473 DRGs are used for some analyses, due to small numbers of separations in some DRGs. In selected analyses those DRGs with thirty or more separations in each study hospital are used. The number thirty is arbitrary, but allows for reasonable cross hospital comparison and

provides a workable number of DRGs. The characteristics of this selected sample are also discussed.

The average DRG weight, or theoretical case mix intensity of all American separations is 1.0. In order to compare this with the case mix intensity of all Alberta hospitals, and specifically of the study hospitals, the sum of DRG weights from all separations is divided by the number of separations. The average DRG weight per separation ratio provides an indication of whether the study sample is more, or less intense in terms of case mix, than the theoretical American system.

Using the selected DRGs with thirty or more separations from each hospital, nursing intensity is described by DRG, and by hospital. Nursing workload index, and nursing hours per episode and per day are described for each DRG.

Because the two months of data may not be typical of the entire year, nor of other Alberta hospitals, two comparisons are made. Using the provincial morbidity file, based on Professional Activities Study (PAS), samples are selected for comparison with all Alberta hospitals and with the study hospitals for other times in the year. Chi-square goodness of fit tests are carried out to assess the frequency distribution of the DRGs in the study sample, relative to all Alberta hospitals, and all times of the year.

3.4.2 Within DRG variability of Nursing Resource Need

Although within DRG variation of nursing resource need is expected the magnitude of this variation may be significant.

Previous studies show some DRGs are more variable than others, and suggest more variable DRGs are more expensive and problematic for management, due to the difficulty in predicting nursing resource need. Within DRG variation of nursing workload index and nursing hours per episode are analyzed for the selected DRGs using standard deviation, and coefficient of variation. The coefficient of variation is a unitless measure of relative variability, derived from dividing the standard deviation by the mean. Coefficient of variation allows comparison between groups with different units of measurement (Kerlinger, 1973). This statistic is useful for comparing hospitals using different patient classification tools, or for comparing variation over DRG categories which have varying average values, as it can provide the variation in percentage form. Observational comment is provided for within DRG variation of nursing resource need.

3.4.3 Between DRG variability of nursing resource need

The DRG weights are based on an assumption that average daily nursing resource need does not vary between DRGs. If this assumption is erroneous, serious financial implications may result when the DRG weights are used for reimbursement or financial planning. To test the assumption, and the resulting ability of the DRG weight to account for nursing resource need, two procedures are carried out. One way analysis of variance (ANOVA) is used to determine whether there is significant differences between the mean nursing resource need measures per day, across the selected DRGs. The nursing

resource need per day is weighted by the length of stay for all separations in the selected DRGs, eliminating bias in estimating daily nursing resource need, due to variation in length of stay.

Secondly, two new variables are computed for each separation by dividing nursing workload index, and nursing hours per episode, by DRG weight. If the DRG weight is able to account for variation of nursing resource need, then the average ratios for each DRG will be reasonably constant. The variation of these ratios is assessed using one-way analysis of variance, (ANOVA) after the ratios are weighted by DRG weight to eliminate bias created by variation of DRG weight between DRGs.

3.4.4 Between hospital variation of nursing resource need

One way analysis of covariance variance, or ANCOVA, is the method used to analyze the variation of nursing resource need per episode between hospitals, for selected DRGs. Inter-hospital variation of nursing resource need per DRG is expected, but the magnitude of variation is the focus of this analysis. For example, whether the difference between hospitals is a matter of ten percent or fifty percent, will have significant implications for financial planning and reimbursement. In order to eliminate bias in estimating variation of nursing resource need, introduced by interhospital differences in numbers of separations per DRG, DRG weight is used as a co-variate in the ANOVA procedure.

3.4.5 Inter-relationships among resource need measures

Correlation analysis is performed on the following variables to determine whether relationships exist and to quantify the magnitude and direction of relationships. All of the sample's 13,591 separations are used. The correlation matrix includes:

1. DRG weight;
2. Age of patient;
3. Sex;
4. Nursing workload index per separation;
5. Nursing hours per separation; and
6. Length of stay.

Pearson r is the statistic used to evaluate the association among DRG weight, age, sex and length of stay.

CHAPTER IV

RESULTS

4.1 DESCRIPTION OF THE DATA

4.1.1 The Sample

The study sample contains 13,591 separations, as shown in Table 1. The distribution of the separations by hospital, sex, age and length of stay reveals the majority of the separations have a short length of stay, and are between 15 and 45 years of age, with slightly more females. Because the study sample is limited to those patients admitted and discharged within a selected 61 day period, those DRGs with shorter length of stay dominate the sample. Appendix A contains the frequency distribution over all 473 DRGs, their associated lengths of stay and nursing resource need measures.

The subset of the sample created by selecting only those DRGs with 30 or more separations in each hospital is shown in Table 2. The most frequently occurring DRG is the obstetrical delivery, closely followed by other obstetrical DRGs. With six DRGs specific to females (373, 359, 371, 372, 381 and 383) and only one specific to males (336), it is not unexpected that the sample contains 13 percent more females than males. Obstetrical diagnoses make up 26.8 percent of all separations. Because hospital two has one of the highest number of annual obstetrical deliveries in Canada, it is not surprising that this hospital contributes 8.3 and 7.2 percent more separations than hospitals three and one, respectively.

TABLE 1

Frequency Distribution of Study Sample
by Hospital, Length of Stay, Age and Sex

	ALL HOSP.	HOSP. 1	HOSP. 2	HOSP. 3
TOTAL SEPARATIONS	13,591	4,252	5,231	4,108
(%)	100	31.3	38.5	30.2
SEX MALE	5,908	1,875	2,080	1,953
(%)	43.5	44.1	39.8	47.5
FEMALE	7,683	2,377	3,151	2,155
(%)	56.5	55.9	60.2	52.5
AGE				
< 15 years	2,994	561	1547	886
(%)	22.0	13.2	29.6	21.6
15 - 45 years	6,098	1,988	2,280	1,830
(%)	44.9	46.8	43.6	44.5
45 - 65 years	2,445	918	726	801
(%)	18.0	21.6	13.9	19.5
65 - 75 years	1,134	455	340	339
(%)	8.3	10.7	6.5	8.3
> 75 years	920	330	338	252
(%)	6.8	7.8	6.5	6.1
LENGTH OF STAY				
1 - 5 days	8,804	2,790	3,456	2,557
(%)	64.8	65.6	66.1	62.2
6 - 10 days	3,077	922	1,207	948
(%)	22.6	21.7	23.1	23.1
11 - 30 days	1,585	504	525	556
(%)	11.7	11.9	10.0	13.5
31 - 61 days	125	36	42	47
(%)	.9	.8	.8	1.1

TABLE 2

Frequency Distribution of
DRGs With 30 or More Separations Per Hospital

DRG	DESCRIPTION	NUMBER OF SEPARATIONS	PERCENT OF TOTAL SAMPLE
373	Vaginal delivery without complications	1087	8.0
391	Normal Newborn	737	5.4
390	Neonate with problems	524	3.9
359	Uterine procedures	273	2.0
389	Full term neonate with major problems	272	2.0
39	Lens procedure	247	1.8
55	Misc. ENT procedure	219	1.6
371	Cesarean section	209	1.4
372	Vaginal delivery with complications	190	1.4
381	Abortion	190	1.4
383	Antepartum complications	178	1.3
183	Esophageal, Gastric Misc. (18-)	134	1.0
243	Medical Back problems	131	1.0
468	Unrelated O.R. procedures	128	.9
182	Esophageal, Gastric Misc. (69+)	122	.9
336	Trans-urethral protatectomy (69+)	102	.8
		4743	27.6

4.1.2 Case mix intensity

In the American DRG system, the sum of all DRG weight units divided by the number of separations, should theoretically produce a ratio of 1.0. Average DRG weights per separation for Alberta, and for each of the study hospitals indicates a measure of case mix intensity. The average DRG weight value for all Alberta hospital separations is .77 (Bay, Maher & Lee, 1989), suggesting a less intense case mix than the American. Of the study hospitals, hospital 3 shows a value higher than the American, with an average weight of 1.07. Hospitals 1 and 2 have a less intense case mix with average

weight of .90 and .77 respectively. The average DRG weight units for the three study hospitals is .89, which is likely higher than all Alberta hospitals because of the nature of the hospitals. Large urban teaching hospitals will understandably admit more complex patients. Differences in the Canadian health care system likely contribute to a case mix which is less intense for Alberta than for the average value of the U.S. system. Hospital beds in Alberta are easily accessed due to the generous supply and the absence of a cost barrier to the patient. Also, there are numerous small hospitals serving relatively isolated populations, where hospitalization may be the only way to monitor a patient. These factors result in easier and more frequent hospital admissions than would be found in the U.S., resulting in a less intense case mix.

4.1.3 Nursing resource need

This section provides indicators of nursing resource need for the selected DRGs, using the Medicus measures of nursing hours (NH) and nursing workload index (WLI). The result is descriptive, and comparative analysis is done in following sections. Table 3 provides a comparison of nursing resource need measures for the selected DRGs. As shown in previous studies, there is a substantial variation of nursing resource need between DRGs and between hospitals.

Nursing hours per day range from 6.05 (DRG 389; full term neonate with major problems), to 3.38 (DRG 373; vaginal delivery without complications). Cross hospital differences in nursing resource need per DRG are also evident, with more pronounced

differences being apparent for hospital 3. For example, nursing hours, per day for DRG 39 (lens procedure) are within 8 minutes for hospitals 1 and 2, but are almost double the hours for hospital 3. This pattern is consistent for most of the 16 DRGs. The range of nursing workload index per day is .89 to 1.93.

4.1.4 Representation of sample

The provincial morbidity file for the 1986/87 fiscal year is used for comparison with the study sample, to determine if the study sample is representative of all separations from Alberta acute care hospitals. Chi-square tests done to compare the study sample with the whole Alberta population of acute care hospital separations show significant differences in distribution by age and length of stay. No significant difference in distribution by sex was found (Table 4). There are also significant differences in the distribution of separations by DRG, between all Alberta hospitals, and the study sample. Therefore, it is unreasonable to assume the study sample is representative of all Alberta acute care hospitals. This fact will limit generalizability of the findings, and conclusions will be limited to the study hospitals.

TABLE 3

Nursing Hours and Nursing Workload Index per DRG

DRG	DESCRIPTION	NH PER DAY				NH PER EPISODE			
		ALL HOS	HOS 1	HOS 2	HOS3	ALL HOS	HOS 1	HOS 2	HOS 3
39	LENS PROC	5.02	3.84	3.98	6.36	17.31	12.34	13.68	22.65
55	MISC ENT PROC	5.03	4.06	4.91	6.47	12.39	10.19	11.43	16.95
182	ESO,GAS+MISC DIG 69+	5.19	4.11	3.57	7.60	34.00	22.26	24.11	60.19
183	ESO,GAS+MISC DIG 18-	3.57	2.75	2.57	5.57	17.19	12.26	14.59	25.30
243	MEDIC BACK PROBLEMS	3.52	2.96	2.42	6.59	18.37	13.44	16.97	29.66
336	TRANSURE PROS 69+	3.80	3.71	3.15	4.39	35.17	31.63	31.74	40.34
359	UT+ADN PROC NMALIG	4.51	3.45	4.09	5.93	27.66	18.88	25.50	37.87
371	CESAREAN SEC W/0 CC	4.17	4.06	3.02	6.53	26.63	25.42	18.77	45.10
372	VAG DELIV W COMP	3.82	3.27	2.05	7.09	19.65	15.51	10.73	38.63
373	VAG DEL W/O COMP	3.38	3.14	1.91	7.23	13.70	13.15	8.51	29.66
381	ABOR W D+C,ASP CUR	4.73	4.74	3.29	7.79	7.72	9.91	4.98	10.28
383	OT ANTEPAR DIAG W CC	4.19	3.91	2.71	5.89	18.88	18.92	10.63	30.13
389	FULL TERM NEO W MAJ	6.05	4.37	5.78	10.38	32.90	21.36	32.77	69.39
390	NEO W OTH SIGNIF PRO	4.51	2.95	4.23	7.38	18.35	11.73	17.36	30.06
391	NORMAL NEWBORN	4.22	2.96	3.88	6.70	16.06	11.74	14.68	25.18
468	UNRELAT OR PROC	5.66	5.95	4.50	6.59	6.00	55.60	46.38	48.80

DRG	DESCRIPTION	NURSING WLI PER DAY				NURSING WLI PER EPISODE			
		ALL HOS	HOS 1	HOS 2	HOS 3	ALL HOS	HOS 1	HOS 2	HOS 3
39	LENS PROC	1.65	1.44	1.35	1.99	5.70	4.64	4.63	7.09
55	MISC ENT PROC	1.68	1.33	1.70	2.12	4.14	3.33	3.96	5.55
182	ESO,GAS+MISC DIG 69+	1.52	1.26	1.23	2.02	9.96	6.84	8.28	15.97
183	ESO,GAS+MISC DIG 18-	1.08	0.88	0.74	1.69	5.22	3.91	4.22	7.57
243	MEDIC BACK PROBLEMS	1.20	0.90	0.87	2.38	6.25	4.10	6.08	10.69
336	TRANSURE PROS 69+	1.15	1.17	0.88	1.36	10.63	9.97	8.84	12.46
359	UT+ADN PROC NMALIG	1.22	1.10	1.04	1.65	7.51	6.00	6.49	10.52
371	CESAREAN SEC W/0 CC	1.13	0.76	0.98	1.71	7.19	4.76	6.08	11.80
372	VAG DELIV W COMP	0.98	0.63	0.65	1.82	5.04	3.00	3.41	9.94
373	VAG DEL W/O COMP	0.89	0.61	0.69	1.88	3.63	2.56	2.73	7.71
381	ABOR W D+C,ASP CUR	1.56	1.46	1.23	2.45	2.54	3.05	1.85	3.23
383	OT ANTEPAR DIAG W CC	1.06	0.80	0.63	1.65	4.78	3.86	2.49	7.45
389	FULL TERM NEO W MAJ	1.93	1.64	1.82	2.80	10.51	8.02	10.33	18.70
390	NEO W OTH SIGNIF PRO	1.56	1.31	1.48	2.12	6.34	5.21	6.07	8.65
391	NORMAL NEWBORN	1.52	1.31	1.43	2.05	5.79	5.19	5.43	7.44
468	UNRELAT OR PROC	1.65	1.57	1.39	1.97	14.53	14.71	14.28	14.59

NOTE: WLI - Workload Index; NH - Nursing Hours

TABLE 4

Sex, Age and Length of Stay Distribution

SEX	OBSERVED FREQUENCY	EXPECTED FREQUENCY*
Male	5908	5627
Female	7683	7964

Note: Chi-square value = 2.806; critical value = 3.841 at 1 degree of freedom and = 0.05

AGE (years)		
<15	2994	3320
15-45	6098	5817
45-65	2445	2190
65-75	1134	1257
>75	920	1367

Note: Chi-square value = 233.48; critical value = 9.488 at 4 degrees of freedom and $\alpha = 0.05$

LENGTH OF STAY (days)		
1-5	8804	9040
6-10	3077	3153
11-30	1585	1632
31-90	125	126

Note: Chi-square value = 9.35; critical value = 7.815 at 3 degrees of freedom and $\alpha = 0.05$

Note: *Expected frequency if the sample is a random sample of the all Alberta separations. (Excluding those with a length of stay greater than 61 days)

TABLE 5

DRG Distribution of Study Sample

DRG	Frequency Observed	Frequency Expected*
39	247	160
55	219	149
182	122	234
183	134	300
243	131	256
336	102	66
359	273	163
371	209	204
372	190	145
373	1087	1072
381	190	234
383	178	152
389	272	246
390	524	432
391	737	813
468	128	118

Note: Chi-square value = 436.96, critical value = 24.996 at 15 degrees of freedom and α = .05;

Note: * expected frequency if the sample is a random sample of all Alberta acute care hospital separations. (Excluding those with a length of stay greater than 61 days).

4.1.5 Comparison of sample with one year period

Tables 6, 7 and 8 show the results of Chi-square tests performed to compare the sample DRG distribution in each hospital with all times of the year. There is no statistical evidence to reject the equivalence of case mix distribution of the study sample and full year sample in hospital 1; however, there is evidence to reject equality of DRG proportions of the study sample and the full year sample for hospitals 2 and 3. Evidently, seasonal variations affect the case mix distribution of hospitals 2 and 3, limiting generalization of the findings to the whole year. It is reasonable to assume the case mix proportions of the study sample are representative of all times of the year for hospital 1, but this is not true for hospitals 2 and 3.

In summary, it is unreasonable to assume the sample is representative of all Alberta acute care hospitals in terms of distribution by age, length of stay, and case mix. Also, the sample is not representative of the whole year for hospitals 2 and 3. Therefore, the findings of this study should not be generalized beyond the study hospitals, or to all seasonal periods.

TABLE 6

Distribution of DRGs by Time of Year

Hospital 1

DRG	Frequency Observed	Frequency Expected*
39	47	49
55	75	64
182	50	49
183	53	54
243	63	83
336	30	30
359	51	35
371	45	48
372	57	55
373	372	368
381	55	59
383	36	33
389	138	140
390	131	145
391	223	209
468	35	40

Note: Chi-square value = 18.12; critical value = 24.996 at 15 degrees of freedom and $\alpha = 0.05$;

Note: *expected frequency if the sample has the same distribution as the whole year.

TABLE 7

Distribution of DRGs by Time of Year

Hospital 2

DRG	Frequency Observed	Frequency Expected*
39	93	92
55	89	82
182	36	30
183	37	38
243	36	27
336	31	35
359	147	92
371	113	113
372	82	71
373	506	479
381	88	239
383	82	90
389	90	85
390	294	240
391	355	363
468	39	42

Note: Chi-square value = 149.79; critical value = 24.996 at 15 degrees of freedom and $\alpha = 0.05$;

Note: *expected frequency if sample has the same distribution as the whole year.

TABLE 8

Distribution of DRGs by Time of Year

Hospital 3

DRG	Frequency Observed	Frequency Expected*
39	107	104
55	55	60
182	36	37
183	44	47
243	32	36
336	41	43
359	75	47
371	51	56
372	51	39
373	209	215
381	47	41
383	60	52
389	44	46
390	99	85
391	159	183
468	54	73

Note: Chi-square value = 35.00; critical value = 24.996 at 15 degrees of freedom and $\alpha = 0.05$;

Note: *expected frequency if the sample has the same distribution as the whole year.

4.2 WITHIN DRG VARIATION OF NURSING RESOURCE NEED

Distribution of nursing resource need estimates within each selected DRG are summarized in Table 9. The mean, standard deviation (SD) and coefficient of variation (CV) of both nursing workload index and nursing hours per episode are provided for each selected DRG. Substantial variation of nursing resource need estimates is indicated by the coefficients of variation, some of which exceed 1.0. Health service utilization data typically exhibits a negative exponential distribution with a theoretical CV of 1.0, therefore any distribution with a CV of greater than 1.0 is considered highly variable, relative to usual utilization patterns. Highly variable nursing resource needs per episode are seen in DRGs 182 (esophageal, gastric and misc. digestive diagnosis 69+); 243 (medical back problems); 372 (vaginal delivery with complications); 383 (other antepartum diagnosis with complications); 389 (full term neonate with major problems); and 468 (unrelated operating room procedures).

These findings support previous studies which show within DRG variation to be extreme, but do not necessarily refute the ProPac assumption of constant average nursing resource need per day, as the length of stay is not controlled. Also, although the DRG based prospective payment system may pay more or less than one patient's nursing resource need, the fairness of payment is meaningful only at the aggregate level, where large numbers of separations are considered. At the aggregate level, the deviations from the average should cancel each other out, unless systematic bias is present. The relevant question is whether or not the aggregate reimbursement

reflects resource need. This question is addressed by inter-DRG comparison of nursing resource need per day, and per DRG weight unit.

The variation does, however, suggest that tactical level decisions about nursing resources will be problematic. Planning for nursing resources within DRGs may be erroneous if the groups of patients are not sufficient to permit the cancelling of deviations from the average. This is not, however, a weakness of the DRG prospective payment system, as it was not designed as a planning tool at this level. Rather, the use of DRGs for tactical level planning of nursing resource need is misuse of a tool designed for macro level reimbursement.

4.3 BETWEEN DRG VARIABILITY OF NURSING RESOURCE NEED

When DRG weights were developed, average nursing resource need per day was assumed constant, and the nursing portion of costs was allocated on a constant, per diem basis. The current DRG weights are based on total costs, and it is uncertain that the weights adequately represent nursing resource need. In order to examine the assumption of constant average daily resource need, and determine if the DRG weights represent nursing resource need, analysis of variance (ANOVA) is carried out.

TABLE 9

Within DRG variability of nursing resource need

A) Within DRG variation of nursing workload index per episode

DRG	DESCRIPTION	MEAN WLI	SD	CV
39	LENS PROCEDURE	5.70	2.44	0.43
55	MISC ENT PROC	4.14	1.77	0.43
182	ESO, GAS & MISC DIG 69+	9.96	13.64	1.37
183	ESO, GAS & MISC DIG 18-	5.22	4.37	0.84
243	MEDICAL BACK PROBLEMS	6.25	7.96	1.27
336	TRANSUR PROS 69+	10.63	4.48	0.42
359	UT & ADN PROC NMALIG	7.51	3.99	0.53
371	CESAREAN SEC W/O COMP	7.19	3.46	0.48
372	VAG DEL W COMP	5.04	5.41	1.07
373	VAG DEL W/O COMP	3.63	3.93	1.08
381	ABOR W D&C, ASP CUR	2.54	1.75	0.69
383	OT ANTEPAR DIAG W CO	4.78	6.15	1.29
389	FULL TERM NEO W MAJ	10.51	11.13	1.06
390	NEONATE W OTH SIG PROB	6.34	4.72	0.74
391	NORMAL NEWBORN	5.79	2.19	0.38
468	UNREL OR PROC	14.53	14.93	1.03

(B) Within DRG variation of nursing hours per episode

DRG	DESCRIPTION	MEAN NH	SD	CV
39	LENS PROCEDURE	17.31	8.53	0.49
55	MISC ENT PROC	12.39	6.79	0.47
182	ESO, GAS & MISC DIG 69+	34.00	56.78	1.67
183	ESO, GAS & MISC DIG 18-	17.19	18.11	1.05
243	MEDICAL BACK PROBLEMS	18.37	20.32	1.05
336	TRANSUR PROS 69+	35.17	15.34	0.44
359	UT & ADN PROC NMALIG	27.66	21.91	0.79
371	CESAREAN SEC W/O COMP	26.63	13.94	0.52
372	VAG DEL W COMP	19.65	21.19	1.08
373	VAG DEL W/O COMP	13.70	12.21	0.89
381	ABOR W D&C, ASP CUR	7.72	6.55	0.85
383	OT ANTEPAR DIAG W CO	18.88	21.88	1.16
389	FULL TERM NEO W MAJ	32.90	42.30	1.29
390	NEONATE W OTH SIG PROB	18.35	18.00	0.98
391	NORMAL NEWBORN	16.06	7.81	0.49
468	UNREL OR PROC	49.92	54.70	1.10

Note: WLI - nursing workload index; SD - standard deviation;
CV - coefficient of variation; NH - nursing hours.

First, the variability of nursing resource need estimates per day is evaluated by estimating deviation of daily nursing resource need per DRG, from the grand mean. Because the per day measures are actually ratios of nursing resource need per episode to length of stay, and there is substantial variation in length of stay, they were weighted by the length of stay to obtain unbiased results. Table 10 presents estimations of deviation from the grand mean for nursing resource need estimates of each selected DRG, including representation in terms of percentage. It is observed that the range of deviation of nursing workload index per day is -32.1 to 47.3 percent; and the range of deviation of nursing hours is -21.6 to 40.4 percent. Even when consideration is given to the fact that the DRG with the largest deviation, 389 (full term neonate with major problems), is typically managed in an intensive care unit, the range is large. If DRG 389 is excluded, the range of deviation from the grand mean is--32.1 to 28.2 percent for nursing workload index per day, and -26.6 to 31.3 percent for nursing hours per day. It appears that the variation of nursing resource need measures does not support the ProPac assumption of constant average daily resource need between DRGs. The operative question, is, however, whether the DRG weights are able to account for nurse resource need as length of stay is no longer directly used for the assignment of weights. To assess this, nursing workload index and nursing hours per episode are divided by the ProPac DRG weight and variation of the resulting ratios is examined. Substantial variation of the ratios is clear for both nursing workload index, and nursing hours. Deviation from the grand

mean for nursing workload index ranges from -48.70 to 125.78 percent, and for nursing hours the range is -46.41 to 90.52 percent (Table 11). The variation suggests that the 1987 ProPac DRG weights do not account for nursing resource need variation between DRG categories, therefore if the weights are used for reimbursement, some hospitals with an unfavourable case mix will not receive a fair reimbursement, while other hospitals will benefit. For example, hospitals with a high proportion of DRG 391 (normal newborn) may be penalized, while hospitals with a high proportion of DRG 381 (abortion) may benefit. DRG 381 requires relatively less nursing resources per DRG weight unit.

However, the study is not a confirmatory one, and the data does not meet the rigorous conditions required for an experimental design study. Also, the sample size of 4,743 is very large, making small deviations from the general mean statistically significant. These facts render the statistical significance of ANOVA less meaningful. Whether or not the demonstrated deviation of nursing resource need from the mean, and the variable ratios constitute significant departures from the ProPac assumption requires further study.

TABLE 10

Between DRG variability of per day nursing resource need estimates

A) Between DRG variability of nursing WLI per day

DRG	DESCRIPTION	DEVIATION FROM OVERALL MEAN	DEVIATION (%)
39	LENS PROCEDURE	0.34	25.99
55	MISC ENT PROC	0.37	28.24
182	ESO, GAS & MISC DIG 69+	0.21	16.03
183	ESO, GAS & MISC DIG 18-	-0.23	-17.56
243	MEDICAL BACK PROBLEMS	-0.11	-8.40
336	TRANSUR PROS 69+	-0.17	-13.00
359	UT & ADN PROC NMALIG	-0.09	-6.70
371	CESAREAN SEC W/O COMP	-0.19	-14.50
372	VAG DEL W COMP	-0.33	-25.19
373	VAG DEL W/O COMP	-0.42	-32.06
381	ABOR W D&C, ASP CUR	0.25	19.08
383	OT ANTEPAR DIAG W CO	-0.25	-19.09
389	FULL TERM NEO W MAJ	0.62	47.33
390	NEONATE W OTH SIG PROB	0.25	19.08
391	NORMAL NEWBORN	0.21	16.03
468	UNREL OR PROC	0.34	25.95

GRAND MEAN = 1.31

(B) Between DRG variability of nursing hours per day

DRG	DESCRIPTION	DEVIATION FROM OVERALL MEAN	DEVIATION (%)
39	LENS PROCEDURE	0.71	16.47
55	MISC ENT PROC	0.72	16.71
182	ESO, GAS & MISC DIG 69+	0.88	20.42
183	ESO, GAS & MISC DIG 18-	-0.75	-17.40
243	MEDICAL BACK PROBLEMS	-0.79	-18.33
336	TRANSUR PROS 69+	-0.52	-12.06
359	UT & ADN PROC NMALIG	-0.20	-4.64
371	CESAREAN SEC W/O COMP	-0.15	-3.48
372	VAG DEL W COMP	-0.50	-11.60
373	VAG DEL W/O COMP	-0.93	-21.58
381	ABOR W D&C, ASP CUR	0.42	9.74
383	OT ANTEPAR DIAG W CO	-0.13	-3.16
389	FULL TERM NEO W MAJ	1.74	40.37
390	NEONATE W OTH SIG PROB	0.20	4.64
391	NORMAL NEWBORN	-0.10	-2.32
468	UNREL OR PROC	1.35	31.32

GRAND MEAN = 4.31

TABLE 11

Between DRG variability of nursing resource need per DRG weight

A) Between DRG variability of nursing WLI per DRGW

DRG	DESCRIPTION	DEVIATION FROM OVERALL MEAN	DEVIATION (%)
39	LENS PROCEDURE	-1.59	-13.75
55	MISC ENT PROC	-2.02	-17.47
182	ESO, GAS & MISC DIG 69+	4.95	42.82
183	ESO, GAS & MISC DIG 18-	-1.32	-11.42
243	MEDICAL BACK PROBLEMS	-2.42	-20.93
336	TRANSUR PROS 69+	-0.79	-6.83
359	UT & ADN PROC NMALIG	-3.63	-31.40
371	CESAREAN SEC W/O COMP	-2.18	-18.86
372	VAG DEL W COMP	-3.07	-26.56
373	VAG DEL W/O COMP	-1.31	-11.33
381	ABOR W D&C, ASP CUR	-4.73	-40.92
383	OT ANTEPAR DIAG W CO	-0.83	-7.18
389	FULL TERM NEO W MAJ	7.82	67.65
390	NWO W OTH SIG PROB	6.64	57.44
391	NORMAL NEWBORN	14.54	125.78
468	UNREL OR PROC	-5.63	-48.70

GRAND MEAN = 11.56

(B) Between DRG variability of nursing hours per DRGW

DRG	DESCRIPTION	DEVIATION FROM OVERALL MEAN	DEVIATION (%)
39	LENS PROCEDURE	-7.72	-20.32
55	MISC ENT PROC	-9.46	-24.90
182	ESO, GAS & MISC DIG 69+	18.37	48.35
183	ESO, GAS & MISC DIG 18-	-4.32	-11.37
243	MEDICAL BACK PROBLEMS	-11.32	-29.80
336	TRANSUR PROS 69+	-2.36	-6.21
359	UT & ADN PROC NMALIG	-8.76	-23.06
371	CESAREAN SEC W/O COMP	-3.27	-8.61
372	VAG DEL W COMP	-4.92	-12.95
373	VAG DEL W/O COMP	0.73	1.92
381	ABOR W D&C, ASP CUR	-17.28	-45.49
383	OT ANTEPAR DIAG W CO	4.42	11.63
389	FULL TERM NEO W MAJ	22.65	59.62
390	NWO W OTH SIG PROB	14.65	38.56
391	NORMAL NEWBORN	34.39	90.52
468	UNREL OR PROC	-17.63	-46.41

GRAND MEAN = 37.99

4.4 BETWEEN HOSPITAL VARIABILITY OF NURSING RESOURCE NEED

Some interhospital variation of nursing resource need is expected, but the magnitude of variation is the relevant issue, as the DRG system does not recognize variation between hospitals. Nursing workload index and nursing hours per episode are compared for hospitals 1, 2 and 3, using one way analysis of covariance. As previously demonstrated, the case mix varies among the study hospitals, therefore DRG weight is used as a covariate to control the variation due to case mix differences. Deviation of both workload index and nursing hours, from the grand mean suggests that between hospital variation of nursing resource need is significant. Variation is as high as 49 percent for workload index, and 59 percent for nursing hours (Table 12). This finding suggests that the nursing resource need is not constant among hospitals. It is suggested that in this application, the differences are primarily due to problems with the Medicus patient classification system. Differences in how the system is used among hospitals includes; different numbers of critical indicators, different critical indicator definitions, and different critical indicator weights. Nursing hours are affected by these factors, as well as different relative values and target hours for each category. The variable nursing hours among hospitals suggests the need for patient classification tools based on absolute measurement of nursing resource needs, rather than measures dependent on the setting and available resources. Only then is it possible to identify patient demands for nursing, separate from the characteristics of the setting. The scope

of the current study does not allow for a complete evaluation of the Medicus patient classification system and assumes the measures to be reliable and valid. It appears the assumptions do not reflect the reality. The findings suggest the need to develop a valid and reliable instrument to measure patient needs for nursing resources applicable to all hospitals. Until such an instrument is available, assessment of DRG weight in respect to nursing resource need is limited, as DRG weight is designed to be used for all hospitals.

4.5 INTER-RELATIONSHIPS AMONG RESOURCE NEED MEASURES

A matrix consisting of the correlation coefficients between DRG weight (DRGW), age of patient, length of stay (LOS), and the nursing resource need measures is presented in Table 13. The entire study sample, is used to produce the matrix. The following is a summary of relevant observations:

1. DRG weight (DRGW) shows a weak, positive correlation with nursing resource need estimates. It appears that DRGW explains only 9 percent of nursing workload index and 16 percent of nursing hour variation per episode. This finding suggests that DRGW is not effective in accounting for variation of nursing resource need.
2. DRG weight shows a modest, positive correlation with length of stay, and length of stay explains 17 percent of variation of DRG weight. If the ProPac assumption of constant average daily resource need was correct, this

TABLE 12

Between hospital variability of nursing resource need ratios

A) Nursing workload index per episode

HOSPITAL	DEVIATION FROM GRAND MEAN	DEVIATION PERCENT
1	-1.17	-18.65
2	-0.95	-14.11
3	3.20	48.91

Grand mean = 5.95

B) Nursing hours per episode

HOSPITAL	DEVIATION FROM GRAND MEAN	DEVIATION PERCENT
1	-3.53	-18.05
2	-3.94	-20.14
3	11.60	59.30

Grand mean = 19.56

Note: Deviation is adjusted for case mix

finding indicates nursing resource need would not be well represented by the DRG weight. However, this finding does not offer any insight to determine if reimbursement for nursing resources would be appropriate.

3. Length of stay has a strong, positive correlation with nursing resource need estimates per episode, suggesting some validity of the ProPac assumption. This is expected as nursing resource need estimates per episode are the weighted sum of length of stay. Length of stay explains 35 and 49 percent of variation in nursing workload index and nursing hours, respectively. The correlation between length of stay and nursing resource need per episode shown here is considerably less than previous studies. For example, Caterinicchio (1984) explained 94 percent of variation in nursing resource need with length of stay, and Harrell (1985) explained 78.5 percent.

4. Age shows a weak, positive correlation with DRGW and nursing resource need estimates, which does not suggest age influences resource need substantially.

The correlation analysis supports the findings of the previous section. DRG weight would not be effective in predicting nursing resource need indicating use of the DRG weight for reimbursement of hospitals for nursing resource need will be inappropriate.

TABLE 13

Pearson Correlation Coefficients

A) ALL HOSPITALS

	DRGW	WL	NH	LOS
DRGW				
WL	.30			
NH	.40	.71		
LOS	.42	.59	.7	
AGE	.28	.07	.08	.22

Note: n = 13,591

B) HOSPITAL 1

	DRGW	WL	NH	LOS
DRGW				
WL	.44			
NH	.45	.97		
LOS	.43	.81	.78	
AGE	.30	.18	.19	.12

Note: n = 4,252

C) HOSPITAL 2

	DRGW	WL	NH	LOS
DRGW				
WL	.39			
NH	.42	.95		
LOS	.45	.75	.73	
AGE	.36	.07	.08	.27

Note: n = 5,231

D) HOSPITAL 3

	DRGW	WL	NH	LOS
DRGW				
WL	.24			
NH	.37	.60		
LOS	.38	.56	.73	
AGE	.19	.06	.04	.17

Note: n = 4,108

Note: DRGW = DRG weight; WL = nursing workload index per episode

NH = nursing hours per episode; LOS = length of stay

4.6 SUMMARY OF RESULTS

The study sample of 13,591 separations is dominated by obstetrical diagnoses and short lengths of stay. The selected sample of those DRGs with thirty or more separations from each study hospital includes 16 DRGs, and 4,743 separations, representing 27.6 percent of the study sample. The case mix of the study sample is less intense than the theoretical American case mix, but more intense than the case mix for all Alberta hospitals. Nursing resource need measures per separation for each DRG are provided for descriptive purposes. Comparison of the study sample with the provincial morbidity file shows the sample is not representative of all Alberta hospitals, or of whole year periods, in terms of case mix.

Large within DRG variation of nursing resource need was noted for some DRGs. This finding has implications for tactical level use of the DRG classification system for planning of nursing resources, but does not necessarily contradict assumptions of the DRG prospective payment system.

Comparison of nursing resource need per day, and per DRG weight unit suggests substantial variation of nursing resources among DRG categories, and limited ability of the DRG weight to account for this variability. A high degree of variation of nursing resource need was shown among the participating hospitals, even after case mix variation was controlled. Due to limitations of the study, and the exploratory nature of its design, conclusions are limited. An analysis of relationships between DRG weight, length of stay, age and nursing resource need revealed a strong relationship between nursing

resource need per episode and length of stay. DRG weight has a weak, positive correlation with nursing resource need, suggesting its inability to account for nursing resource need variation.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY

Previous studies have cast doubt on the ability of the DRG classification system and its' weights to represent nursing resource need, and have attributed the problem to a variation of nursing resource need within and between DRGs. In spite of the controversy, DRGs continue to be used in the U.S. and initiatives exist for use of DRGs and CMGs in Canada. This exploratory study sought to examine the relationships between DRGs, DRG weights and nursing resource need measures and utilized existing data on 13,591 separations from three large, Alberta teaching hospitals. The Medicus patient classification system was used to measure nursing resource need.

The selective review of the literature described historical development of nursing patient classification systems and case mix classification systems, followed by a description of studies of their relationships. Most studies used nursing patient classification systems to demonstrate within and between DRG variation of nursing resource need, and concluded DRGs are not an appropriate measure of nursing resource need. Other studies refuted this conclusion and stated the DRG weight does provide adequate precision for reimbursement of hospital nursing resources. All studies encouraged further research on the relationships between DRGs and nursing resource need.

A conceptual model was proposed to provide a framework for analysis, depicting the interdependence of medical diagnosis,

severity of illness, length of stay and nursing resource need. Data analysis was descriptive and analytical, but not inferential, and included an assessment of the sample. The statistical analysis included: 1) within DRG variability of nursing resource need; 2) between DRG variability of nursing resource need; 3) between hospital variability of nursing resource need; and 4) correlation analysis.

A description of the entire sample was provided and a sub-sample, based on numbers of separations, was created for indepth analysis and cross-hospital comparison. The sample was assessed in terms of case mix intensity, and representativeness of all Alberta hospital separations, and a whole year period. Nursing resource need was described for each selected DRG.

The analysis focused on nursing resource need per day and per DRG weight unit, and an examination of the ProPac's assumption of proportionality between length of stay, and nursing resource need. As actual payment from the U.S. Government for Medicare patients is proportional to DRG weights, the ability of DRG weight to explain variation of nursing resource need was examined by analyzing nursing resource need per DRG weight unit. Observational comment was provided for within DRG variation of nursing resource need. The relationships between DRG weight, nursing resource need, length of stay and age were explored using correlation analysis.

5.2 FINDINGS

The major findings of previous studies described in the literature review, which are relevant to the study objectives are:

1. The current DRG classification system is based on medical diagnosis and cost. The relative weight for each category reflects cost differences, but does not explicitly include nursing cost due to unavailability of data. Average nursing resource need per day was assumed constant in development of the weights.
2. Studies have shown nursing resource need to vary substantially, unrelated to length of stay.
3. Nursing resource need as measured by patient classification systems, when used with DRG weights, explains more variation of hospitals than DRG weights alone.
4. ProPac's 1988 assessment of DRGs and nursing resource need concluded that adjusting the DRG weights to reflect a measure of nursing resource need did not significantly affect reimbursement at the aggregate level.

The findings resulting from the analysis of this study indicate:

1. Within DRG variation of nursing resource need per episode is substantial.
2. Variation of nursing resource need per day among DRGs is also substantial.

3. Variation of nursing resource need per DRG weight unit across DRGs is also substantial.
4. Nursing resource need per DRG weight unit shows large variation among study hospitals, even when case mix is controlled.
5. DRG weight shows a modest, positive correlation to nursing resource need estimates.

5.3 CONCLUSIONS

The objectives of this study were to: 1) assess the homogeneity of nursing resource need per day; 2) examine the ability of the DRG weight to account for nursing resource need; and 3) evaluate relationships between DRG weights and nursing resource need. In light of these objectives, and the major findings resulting from this study, the following conclusions are made:

1. DRGs will not be effective in allocating nursing resources on a tactical level as the variation within DRG categories is substantial. It is noted that DRGs were not designed to meet internal hospital planning needs, so this is not a weakness of DRGs.
2. The ProPac assumption of constant average daily resource need appears to be invalid for the study sample, as variation is shown to be substantial.
3. The ProPac DRG weights are unable to account for variation of nursing resource need, as shown by the variation of nursing resource need per DRG weight unit,

and the weak correlation between DRG weight and nursing resource need.

4. If DRG weights were used to reimburse the study hospitals, the hospitals would not receive appropriate funds for nursing resource need, as measured by the Medicus patient classification system.

5.4 LIMITATIONS

The conclusions of this study must be viewed in consideration of several limitations which include:

1. The data used for the study are not representative of all Alberta acute care hospital and patients, nor of all times of the year;
2. The separations used in the study are from a 61 day period, limiting the sampled to DRGs to shorter length of stay categories;
3. The accuracy of the abstracted data cannot be assured;
4. The applicability of the ProPac DRG weights to Alberta hospitals is unknown;
5. Intensive care unit days are not differentiated in the study data;
6. The Medicus classification system is a limited measure of nursing resource need, as it does not measure nursing resource need in absolute terms;
7. There are differences in cross hospital use of the Medicus tool; and

8. Reliability problems are identified in the Medicus data.

5.5 RECOMMENDATIONS

Based on the preceding major findings and conclusions, the following recommendations are offered:

1. Prospective payment systems based on DRG weights should be adjusted to include nursing resource need. As there are no tools to measure nursing resource need in absolute terms, further research is required. It may be possible to cluster DRGs according to their intensity of nursing resource needs, and it is doubtful that 473 DRGs will all have distinctly different requirements for nursing resources. The Yale Study (1988) provides a framework which may be used to define DRG clusters by nursing resource need.
2. DRGs and their weights should not be used for tactical level decisions about nursing resource need allocation.
3. Development of a patient classification system which will measure nursing resource need in absolute terms is recommended. A tool for both inter and intra hospital comparison of nursing resource need is important if DRGs or CMGs are used for hospital reimbursement.
4. Further study into the hospital and patient specific factors which influence nursing resource need should be carried out.

5. This study should be repeated, using a more representative sample. The study should provide more control for nursing unit differences, and for differences in the patient classification system and its application. It is also recommended that actual hours of nursing care provided to patients be included in the study, in order to provide a measure of actual cost.

BIBLIOGRAPHY

Abdellah, F.G. & Levine, E. (1979). Better patient care through nursing research. 2nd edition, (pp. 472-496). New York: MacMillan Publishing Co.

Adams, R. & Johnson, B. (1986). Acuity and staffing under prospective payment. Journal of Nursing Administration, 16(10), 21-25.

Alberta Hospitals and Medical Care, Health Economics and Statistics (1986). Measuring case mix in Alberta active treatment hospitals. Unpublished paper.

Altman, S.H. & Young, D.A. (1988). Medicare prospective payment and the American Health Care System. Report to the U.S. Congress, June 1st.

_____. (1988). Report and recommendations to the secretary, U.S. Department of Health and Human Services, March 1st.

Alward, R. (1983). Patient classification systems: Ideal vs. reality. Journal of Nursing Administration, 13(2), 14-19.

Arndt, M. & Skydell, B. (1985). Inpatient nursing services: Productivity and cost. NLN Publication 20-1982, pp. 135-153.

Atwood, J.R., Hinshaw, A.S. & Chance, H.C. (1986). Relationships among nursing care requirements, nursing resources and charges. In F.A. Shaffer (ed.), Patients and Pursestrings: Classification and Cost Management. National League of Nursing Publication 20-2155,

Auger, J.D. & Dee, V. (1983). A patient classification system based on the behavioural system model of nursing: Part 1. The Journal of Nursing Administration. April, 38-43.

Ballard, D., Barach, K.B. & Cullen, J.J. (1985). The variable nursing charge system at the Hospital of Saint Raphael. Costing Nursing Services. National League of Nursing Publication 20-1982, 101-111.

Bargagliotti, L.A. & Smith, H. (1985). Patterns of nursing costs with capitated reimbursement. Nursing Economics, 3(5), 270-175.

Bay, K., Maher, M. & Lee, S. (1989). Utilization of Hospital Services by Hospital Patients, Alberta, Canada. American Journal of Public Health, 79, 759-764.

Boadway, Q. & Brown, M.E. (1987). Kingston General reviews use of CMGs as a management tool. Dimensions in Health Service, 64(3), 24-16.

Botz, C.K. (1985). CMGs and DRGs: Can they improve efficiency? Dimensions, Sept., 40-41.

Botz, C.K. (1989). Weighting case mix groups: the fatal flaw in Resource Intensity Weights. Forum, 2(1), 8-11.

Buck, E.A. (1986). Correlating patient classification and DRGs. In F.A. Shaffer (ed.) Patients and Pursestrings: Patient Classification and Cost Management. National League of Nursing Publication 20-2155, 83-97.

Canadian Hospital Directory. (1988). Volume 36, Sept.

Canadian Nurses Association (1966). Report on the project for the evaluation of the quality of nursing service. Ottawa.

Carmichael, D. (1988). Case weighting methods: A review by the HMRI Database Committee. Unpublished report.

Caterinicchio, R.P. (1984). Relative intensity measures: Pricing the inpatient nursing services under diagnosis-related group prospective hospital payment. Health Care Financial Review, 6(1), 61-70.

Caterinicchio, R.P, Grimaldi, P.L. & Micheletti, J.A. (1983). A debate: RIMs and the cost of nursing care. Nursing Management, 14(5), 36-41.

Chagnon, M., Audette, L., Lebrun, L. & Tilquin, D. (1978). Validation of a nursing classification system through evaluation of nursing staff degree of occupation. Medical Care, 6, 465-475.

_____. (1987). A patient classification system by level of care required. Nursing Research, 27, 107-112.

Claussen, E. (1955). Categorization of patients according to nursing care needs. Military Medicine (March), 209-214.

Coffey, R.M. & Goldfarb, M.G. (1986). DRGs and disease staging for reimbursing of medicare patients. Medical Care, 24(9), 814-828.

Commission on Hospital and Professional Activities (1978). What is an RNI? CPHA 922-3-78, Ann Arbor, Michigan.

_____. (1986). Analysis of significant trends and differences between hospitals and their peers. Final Report, Submitted to Alberta DHMC, Aug.

Congress of the United States (1985). Medicare's Prospective Payment System. U.S. Government Printing, Washington, D.C.

Connor, R.J. (1961). A work sampling study of variations in nursing workload. Hospitals, J.A.H.A., 35, 30-39.

Crawford, M. & Fotter, M. (1985). The effect of diagnosis related groups and prospective pricing system on health care management. Health Care Management Review, 10(4), 73-84.

Cromwell, J. & Price, K. (1988). The sensativity of DRG weights to variation in nursing intensity. Nursing Economics, 6(1), 18-26.

Curtin, L. (1983). Determining costs of nursing services per DRG. Nursing Management, 14(4), 16-20.

Dahlen, A.L. & Gregor, J.R. (1985). Nursing costs by DRG with an all RN staff. National League of Nursing Publication, 20-1982, 113-121.

Dale, R.L. & Mable, R.J. (1983). Nursing classification system: Foundation for personnel planning and control. Journal of Nursing Administration, Feb., 10-13.

Deines, E. (1985). Coping with PPS and DRGs: The levels-of-care approach. Nursing Management, 16(10), 43-52.

Demlo, L.K., Campbell, P.M. & Brown, S.S. (1978). Reliability of information abstracted from patients' medical records. Medical Care, 16(12), 995-1004.

Dijkers, M. & Paradise, T. (1986). PCS: One system for both staffing and costing. Nursing Management, 17(1), 25-34.

Edwardson, S.R. & Giovannetti, P.G. (1987). A review of cost accounting methods for nursing services. Nursing Economics, 5(3), 107-117.

Ethridge, P. (1985). The case for billing by patient acuity. Nursing Management, 16(8), 38-41.

Evans, R.G. (1984). Strained Mercy: The Economics of Canadian Health Care. Toronto, Butterworths.

Feldman, J. (1984). Living with DRGs. The Journal of Nursing Administration, May, 19-22.

Fetter, R.B., Shin, Y., Freeman, J.L., Averill, R.F. & Thompson, J.D. (1980). Case mix definition by diagnostic related groups. Medical Care, 18, Supplement.

Fetter, R.B. & Thompson, J. (1987). Diagnosis related groups and nursing resources. (Final report grant no. 15-C-98500/1-02) Washington, D.C.: Health Care Financing Administration.

Flagler, C.D. (1960). The problem of organization for hospital inpatient care. Management sciences: Models; Techniques. Proceedings of the Annual International Meeting of the Institute of Management Sciences. vol. 2, 275-287.

Fosbinder, D. (1986). Nursing costs/DRG: A patient classification system and comparative study. Journal of Nursing Administration, 16(11), 18-23.

Gabrielson, R.C. & Lund, C.A. (1985). Enhancing the financial and operational performance of the nursing department. Journal of Nursing Administration, 15(11), 28-32.

Giovannetti, P.(1978). Patient classification systems in nursing: A description and analysis. Baltimore: U.S. Department of Health, Education and Welfare.

_____. (1979). Understanding patient classification systems. Journal of Nursing Administration, 9(2), 4-9.

_____. (1984). Building confidence in patient classification systems. Nursing Management, 15, 31-34.

_____. (1984). Staffing Methods-Implications for Quality. In L. Willis & P. Linwood (Eds.) Measuring Quality of Nursing Care. London: Churchill Livingston, pp. 123-150.

_____. (1985). Compatibility among existing patient classification systems with a nursing minimum data set. Paper commissioned for Nursing Minimum Data Set Conference, Milwaukee, Winsconsin.

_____. (1985). Computerized nurse staffing systems: Issues of effectiveness. In K.J. Hannah, E.J. Guillemin & D.N. Conklin (eds.). Proceedings of the IFIP-IMIA International Symposium on Nursing Uses of Computers and Information Science. New York: North Holland, pp. 149-153.

_____. (1985). DRGs and nursing workload measures. Computer Nurse, 3(2), 88-91.

_____. (1986). Where do we go from here? In F.A. Shaffer (Ed.). Patients and Pursestrings: Patient Classification and Cost Management. National League of Nursing Publication 20-2155, 349-358.

_____. (1987). Implications of a nursing minimum data set. Paper presented at the Clinical Judgement and Decision Making: The Future with Nursing Diagnosis. International Nursing Conference, Calgary, Alberta.

_____. (1988). Patient Classification Systems Guiding the Organization and Quality of Nursing Practice. Keynote presentation at the Fourth Open Conference of the Workgroup of European Nurse Researchers, Jerusalem, Israel, June.

Giovannetti, P., Edwardson, S. & Busch, W. (1984). Relationship between DRG and patient classification data for nursing costs and allocations. Presentation at the American Society for Nursing Service Administrators, October 24, Chicago.

Giovannetti, P. & Mayer, G.G. (1984). Building confidence in patient classification systems. Nursing Management, 15(8), 31-34.

Glaser, W. (1980). Paying the Hospital in Canada. New York: Columbia University, Center for the Social Sciences.

Green, J., McClure, M., Wintfeld, N., Birdsall, C. & Rieder, K. (1988). Severity of illness and nursing intensity: Going beyond DRGs. In Scherubel, J. & Shaffer, F.A. (eds.) Patients and Pursestrings 11. National League of Nursing Publication 20-2191, 207-230.

Grimaldi, P.L. (1982). DRGs and nursing administration. Nursing Management, 13(1), 30-34.

Grimaldi, P.L. & Micheletti, J.A. (1982). DRG reimbursement: RIMs and the cost of nursing care. Nursing Management, 13(12), 12-22.

Grohar, M.E., Myers, J. & McSweeney, M. (1986). A comparison of patient acuity and nursing resource use. The Journal of Nursing Administration, 16, 19-23.

Guterman, S. & Dobson, A. (1986). Impact of the Medicare prospective payment systems for hospitals. Health Care Financing Review, 7(3), 97-114.

Haas, S.W. (1984). Sorting out nursing productivity. Nursing Management, 15, 37-40.

Hagerty, B.H., Chang, R. & Spengler, C.D. (1985). Work sampling, analyzing nursing staff productivity. The Journal of Nursing Administration, 15, 9-14.

Halloran, E.J. (1985). Nursing workload, medical diagnosis related groups and nursing diagnosis. Research in Nursing and Health, 8(4), 421-433.

Halloran, E.J. & Halloran, D.C. (1985). Exploring the DRG/nursing equation. American Journal of Nursing, 10, 1093-1095.

Halloran, E.J. & Kiley, M. (1984). Case mix management. Nursing Management, 15(2), 39-41, 44-45.

_____. (1985). The nurses' role and length of stay (letter). Medical Care, 23(9), 1122-1126.

_____. (1987). Nursing dependency, diagnosis-related groups, and length of hospital stay. Health Care Financial Review, 8(3), 27-36.

Halloran, E.J., Patterson, C. & Kiley, M. (1987). Case-mix: Matching patient need with nursing resource. Nursing Management, 18(3), 27-30, 32, 36.

Hardwick, J.M. (1981). The RNI as Case Mix Indicator: Promise and Performance. Unpublished Master's Thesis, University of British Columbia, Vancouver, B.C.

Harrell, J.S. (1986). Predicting nursing care costs with a patient classification system. In F.A. Shaffer (ed.) National League of Nursing Publication 20-2155.

Harron, J. Schaeffer, J. (1986). DRGs and the intensity of skilled nursing. Geriatric Nursing, 7(1), 31-33.

Henderson, V. (1966). The nature of nursing: A definition and its implications for practice, research and education. New York, MacMillan Pub.

Horn, S.D. & Sharkey, P.D. (1983). Measuring severity of illness to predict patient resource use within DRGs. Inquiry. Winter.

Horn, S.D. & Schumaker, D. (1982). Comparing classification methods: Measurement of variation of charges, length of stay and mortality. Medical Care, 5, 489-500.

Hornbrook, M. (1982). Hospital case mix: It's definition, measurement and use. Medical Care Review, Spring, 1-43.

Hundert, M. & Stewart, D. (1984). University Hospital tries Medicus case mix analysis. Dimensions, Sept., 45-48.

Jackson, B.S. & Resnick, J. (1982). Comparing classification systems. Nursing Management, 13, 13-19.

Jelinik, R.C. & Dennis, L.C. (1976). A review and evaluation of nursing productivity. DHEW Publication No. (HRA) 77-15.

Joel, L.S. (1983). DRGs: The state of the art of reimbursement for nursing services. Nursing and Health Care, 4(10), 560-5653.

_____. (1984). DRGs and RIMs: Implications for nursing. Nursing Outlook, 32(1), 42-49.

_____. (1984). Relative Intensity Measures (RIMs) and the state of the art for reimbursement for nursing services. In F.A. Shaffer (ed.) DRGs: Challenges and Changes, National League for Nursing Publication, 57-64.

Jones, K.R. (1984). Severity of illness measures: Issues and options. Nursing Economics, 2(5), 312-317.

_____. (1987). Severity of illness measurement systems: An update. Nursing Economics, 5(6), 292-296.

Kawczak, M.K., Chang, R.S. & Spengler, C.D. (1985). Work sampling: Analyzing nursing productivity. Journal of Nursing Administration, 15(9), 9-19.

Kerlinger, F.N. (1973). Foundations of Behavioral Research. 2nd. edition. Holt, Rinehart and Winston Inc., New York.

Kirby, K.K. (1986). Survey regarding factors influencing nursing hours. Nursing Economics, 4(6), 310-313.

Klastorin, R.D. & Watts, D.W. (1980). On the measurement of case mix. Medical Care, 18(6), 675-685.

Lagona, T.G. & Stritzel, M.M. (1984). Nursing care requirements as measured by DRG. Journal of Nursing Administration, 14(15), 15-18.

LeFevre, T.D. (1985). Patient acuity and DRGs: Some findings regarding relationships. Software in Healthcare, 3(1), 62-67.

Levine, E. (1985). Some issues in nursing productivity. In F.A. Shaffer (ed.) Costing Out Nursing: Pricing our Product. National League of Nursing Publication, 237-253.

Levine, E. & Abdellah, F.G. (1984). DRGs: A recent refinement to an old method. Inquiry, 21(2), 105-112.

Lucke, K. & Lucke, J. (1986). Severity of illness and nursing intensity as predictors of treatment costs. In F.A. Shaffer (ed.) National League of Nursing Publication, 20-2155.

Luke, R.D. (1979). Dimensions in hospital case mix measurement. Inquiry, 16(38).

McClain, J.R. & Selhar, M.S. (1984). Twenty cases: What nursing costs per DRG. Nursing Management, 15(10), 27-34.

McGeorge, K.R., DeMora, A. & Legros, G. (1985). A case mix management system. Health Management Forum, Summer, 53-64.

McKibbin, R.C., Brimmer, P.F., Galliher, J.M., Hartley, S.S. & Clinton, J. (1985). Nursing costs and DRG payment. American Journal of Nursing, (12), 1353-1356.

_____. (1985). DRGs and Nursing Care. Missouri, American Nurses Association.

Medicus Canada. (1987). External audit of the use and application of the Medicus Nursing Management System. Final Report.

Meijers, A. (1982). MIS team evaluates patient classification systems. Dimensions in Health Services, 59, 25-26.

Mitchell, M., Miller, J., Welches, L. & Walker, D.D. (1984). Determining cost of direct nursing care by DRGs. Nursing Management, 15(4), 29-32.

Mowry, M.M. & Korpman, R.A. (1985). Do DRG reimbursement rates reflect nursing costs? Journal of Nursing Administration, 15(7-8), 29-35.

Mullen, R.L. (1985). Diagnosis related groups and severity; ICD-9-CM, the real problem. Journal of the American Medical Association, 245(9), 1208-1210.

National League of Nursing Education (1947). A study of pediatric nursing. New York: N.L.N.E.

Nyberg, J. & Wolff, N. (1984). DRG panic. Journal of Nursing Administration, 14(4), 17-21.

O'Brien, L.L. (1987). Analysis of variation in nursing workload associated with patient's medical and nursing diagnosis and patient classification method. Unpublished Doctoral Thesis, University of Toronto.

O'Leary, J. (1985). A nursing management system: DRGs, productivity, and monitoring. In F.A. Shaffer (ed.) National League of Nursing Publication 20-1982, 155-169.

Overfelt, F.C. (1988). The fixed reireidermbursement perspectives on patient care services: An enlightened view of nursing. In J.C. Scherubel & F.A. Shaffer (eds.) Patients and Pursestrings 11, National League of Nursing Publication No. 20-2191, 27-38.

Panniers, T.L. & Tomkiewicz, Z.M. (1985). The ICD-9-CM DRGs: Increased homogeneity through use of the AS-SCORE. Quality Review Bulletin, 11(2), 47-52.

Petit, B., Kavois, J. & Glandon, G. (1988). A multihospital data base of nursing costs. In Shaffer, F.A. (ed.) Patients and Pursestrings 11, National League of Nursing Publication No. 20-2191, 166-173.

Piper, L.R. (1983). Accounting for nursing functions in DRGs. Nursing Management, 14(1q), 46-48.

Plowman, M.P. & Shaffer, F.A. (1984). DRGs as one of nine approaches to case mix in transition. In F.A. Shaffer (ed.) DRGs: Changes and Challenges. National League of Nursing Publication No. 20-1959, New York, 35-46.

Prescott, P.A. (1986). DRG prospective reimbursement: The nursing intensity factor. Nursing Management, 17(1), 43-46.

Price, K.F. & Tomaselli, E.L. (1988). Pro-Pac's assessment of DRGs and nursing intensity. Nursing Economics, 6(1), 10-16.

Reitz, J.A. (1985). Toward a comprehensive nursing intensity index: Part II, Testing. Nursing Management, 16(9), 31-42.

Reschak, G.L., Biordi, D., Holm, K. & Santucci, N. (1985). Accounting for nursing costs by DRG. Journal of Nursing Administration, 15(9), 15-20.

Richards, M.L., Hexum, J.G. & Anderson, R. (1987). Patient care demands by DRG: A pilot study. Nursing Economics, 5(3), 125-129.

Rieder, K.A. & Kay, T.L. (1985). Severity of illness within DRGs using nursing patient classification system. Costing Nursing Services. National League of Nursing Publication 20-1982, 85-99.

Riley, W. & Schaefers, V. (1983). Costing nursing services. Nursing Management, 14(12), 40-43.

Scherubel, J.C. & Swartz, J.A. (1988). Developing a model for predicting hospital resource consumption. In J.C. Scherubel & F.A. Shaffer (eds.) Patients and Pursestrings II. National League of Nursing Publication No. 20-2091, 131-143.

Shaffer, F. (ed.) (1984). DRGs: Challenges and Changes. New York: National League for Nursing.

_____. (1984). DRGs: History and overview. In F.A. Shaffer (ed.) DRGs: Changes and Challenges. National League of Nursing Publication No. 20-1959. New York, 15-34.

_____. (1985). Costing out nursing: Pricing our product. New York: National League for Nursing Publication.

Sherrod, S. M. (1984). Patient classification systems: A link between diagnosis related groupings and acuity factors. Military Medicine, 149, Sept., 506-511.

Smith, D.W., Hogan, A.J. & Rohrer, J.E. (1987). Activities of daily living as quantitative indicators of nursing effort. Medical Care, 25(2), 120-130.

Social Security Administration. (1976). Progress reports of July, 1976 and October, 1976 - Development, testing and evaluation of a Prospective Case - Payment Reimbursement System. Contract No. 600-75-0180.

Sovie, M.D. (1985). Managing nursing resources in a constrained economic environment. Nursing Economics, 3(2), 85-94.

Sovie, M.D., Tarcinale, M.A., VanPuttee, A.W. & Stunden, A.E. (1985). Amalgam of nursing acuity DRGs and nursing costs. Nursing Management, 16(3), 22-42.

Staley, M. & Luciano, K. (1984). Eight steps to costing nursing services. Nursing Management, Oct., 35-38.

Stoughton, W.V. (1983). DRGs from a Canadian standpoint. Health Care, Oct., 13-14.

Thompson, J.D. (1981). Prediction of nurse resource use in treatment of diagnosis related groups. Nursing Information Systems. Werley, H.W. (ed.) New York, Springer Publishing Co.

____. (1984). The measurement of nursing intensity. Health Care Financial Review. Supplement, 47-55.

Thompson, J.D. & Diers, D. (1985). DRGs and nursing intensity. Nursing and Health Care, 6(8), 435-439.

Thompson, J.D., Fetter, R.B. & Mross, C.D. (1975). Case mix and resource use. Inquiry, 12(10),300-312.

Thorpe, K.E. (1987). The distributional implications of using relative prices in the DRG payment system. Inquiry, 24, 85-95.

Talerico, L. & Diers, D. (1988). Nursing intensity outliers. Nursing Management, 19(6), 27-33.

Trandel-Korenchuk, D.M. & Trandel-Korenchuk, K.M. (1984). Medicare, DRGs and nursing practice. Nursing Administration Quarterly, 8(4), 85-87.

Trofino, J. (1986). Reality based system for pricing nursing services. Nursing Management, 17, 19-24.

Unger, J. (1985). Building a classification system that works. The Journal of Nursing Administration, 15, 18-24.

Vaughan, R.G. & MacLeod, V. (1985). Comparing acuity among hospitals. Who has the sickest patients? Journal of Nursing Administration, 15(5), 25-28.

Williams, S.V., Kominsky, G.F. & Dickens, G. (1985). DRGs, Disease Staging and Variance Reduction. Report prepared for the National Center for Health Services Research and Health Care Technology Assessment. (Grant No. HS-04916), July.

Wolfe, G.A. & Lesic, L.K. (1986). Determining the cost of nursing care within DRGs. In F.A. Shaffer (ed.) Patients and Pursestrings. National League of Nursing Publication 20-2155.

Wood, C.T. (1982). Relate hospital charges to use of services. Harvard Business Review. March-April.

Young, W.W., Swinkola, R.B. & Zorn, D.M. (1982). The measurement of hospital case mix. Medical Care, 20(5), 501-512.

Zuckerman, A.M. (1983). Diagnosis related groups: Applications for Canada. Health Management Forum, 4(4), 66-74.

APPENDIX A

APPENDIX A
SUMMARY STATISTICS

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
1	Cran 17+ exc Trauma	2.26	52	0.23	1.82	6.93	9.9
2	Cran 18-	1.91	12	0.18	3.32	14.98	10.8
3	Cran 18+	2.92	14	0.21	3.22	12.73	13.9
4	Spinal Proced	2.27	12	0.25	2.15	4.83	9.0
5	Extracran Vasc Proced	1.24	4	0.18	1.48	4.04	6.8
6	Carpal Tunnel Rel	0.20	22	0.08	1.49	4.82	2.6
7	Per+Cran Nerv+Oth Ner 69+	0.99	7	0.12	2.70	9.91	8.1
8	Per+Cran Nerv+Oth Ner 70-	0.62	23	0.16	1.40	4.30	3.8
9	Spinal Disor+Injur	1.42	2	0.05	1.72	5.58	26.5
10	Nerv Sys Neopl 69+ A/O CC	0.85	8	0.15	2.33	8.67	5.8
11	Nerv Sys Neopl 70- W/O CC	0.56	5	0.08	0.91	2.82	6.8
12	Degen Nerv Sys Disord	0.45	22	0.05	1.74	6.11	8.4
13	MS + Cereb Ataxia	0.81	17	0.06	1.84	6.32	12.6
14	Spec CerVas Disor Exc Tia	0.90	57	0.08	1.57	5.22	11.4
15	Tran Isch Attck+Prec Occl	0.46	31	0.07	1.14	3.56	6.4
16	Nonsp CereVas Disor w CC	0.54	5	0.09	0.97	2.94	6.2
17	Nonsp CereVas Diso w/o CC	0.68	3	0.09	0.67	1.96	8.0
18	Cran+Per Nerv Dis 69+ CC	0.50	12	0.05	1.22	4.03	11.1
19	Cran+Per Nerv Dis 69+ CC	0.34	21	0.06	0.86	2.64	5.5
20	Nerv Sys Infec Ex Vir Men	1.09	22	0.11	2.06	7.60	9.9
21	Viral Mening	0.00	1	0.00	1.20	4.20	5.0
23	Nontraum Stupor+Coma	1.12	2	0.28	1.63	5.75	4.0
24	Seiz+Headache 69+ A/O CC	0.47	36	0.10	1.69	5.56	4.6
25	Seiz+Headache 18-69 wo CC	0.39	53	0.10	1.17	3.77	4.0
26	Seiz+Headache 0-17	0.60	64	0.18	2.11	6.96	3.3
27	Trau Stupor+Coma 1Hr.+	0.91	12	0.34	3.28	11.69	2.7
28	Trau Stup+Com 1hr.- 69+	0.47	14	0.07	1.51	5.21	6.4
29	Trau Stup+com 1hr.-18-69	0.50	18	0.15	1.43	4.36	3.4
30	Trau Stup+Coma 1hr.- 0-17	0.32	19	0.19	3.03	8.39	1.6
31	Concuss 69+ A/O CC	0.32	5	0.18	1.67	4.22	1.8
32	Concuss 18-69 W/O CC	0.35	7	0.22	2.36	6.27	1.6
33	Consuss 0-17	0.18	15	0.14	3.05	9.40	1.3
34	Oth Dis NervSys 69+A/O CC	0.65	15	0.11	1.85	3.67	6.1
35	Oth Dis NervSys 70-W/O CC	0.61	23	0.12	1.20	3.94	5.1
36	Retinal Proc	0.39	45	0.08	1.37	3.97	5.1
37	Orbital Proc	0.29	7	0.04	1.22	4.17	7.7
38	Primary Iris Proc	0.32	5	0.07	1.38	4.29	4.8
39	Lens Proc W/WO Vitrectomy	0.46	247	0.13	1.65	5.02	3.4

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
40	Extraoc Proc ex Orbit 17+	0.21	22	0.07	1.58	5.15	3.0
41	Extraoc Proc ex Orb 0-17	0.37	9	0.15	2.00	7.27	2.4
42	Intocc Proc x RetIrisLens	0.57	46	0.10	1.61	5.17	5.4
43	Hyphema	0.28	15	0.08	1.41	4.45	3.4
44	Acut Maj Eye Infect	0.48	4	0.06	1.61	6.42	7.8
45	Neuro Eye Disord	0.34	11	0.07	1.28	4.34	4.8
46	Oth Dis of Eye 17+ W CC	0.46	13	0.08	1.37	4.00	6.1
47	Oth Dis of Eye 17+ W/O CC	0.33	19	0.09	1.24	3.97	3.7
48	Oth Dis of Eye 0-17	0.40	3	0.17	2.43	5.86	2.3
49	Maj Head+Neck Proc	2.05	7	0.17	2.22	7.64	12.3
50	Sialoadenectomy	0.35	12	0.09	1.60	5.40	3.9
51	Sal Gland Proc x Sialoa	0.20	3	0.03	0.89	2.67	6.0
52	Cleft Lip+Palate Rep	0.70	3	0.23	3.00	11.56	3.0
53	Sinus+Mastoid Proc 17+	0.35	42	0.12	1.56	4.82	3.0
54	Sinus+Mastoid Proc 0-17	0.46	3	0.20	2.57	9.00	2.3
55	Misc ENT Proc	0.29	219	0.12	1.68	5.03	2.5
56	Rhinoplasty	0.09	19	0.05	1.51	5.84	1.9
57	T+A Proc x TonA/OAden 17+	0.64	6	0.26	1.47	4.27	2.5
58	T+A Proc x TonA/OAden0-17	0.28	9	0.14	2.67	7.11	2.0
59	Tonsi A/O Aden 17+	0.25	39	0.11	1.54	4.40	2.2
60	Tonsi A/O Aden 0-17	0.24	97	0.11	2.37	7.51	2.1
61	Myring w Tube Inser 17+	0.21	4	0.12	2.00	4.71	1.8
62	Myring w Tube Inser 0-17	0.31	10	0.14	2.05	5.82	2.2
63	Oth ENT O.R Proc	0.74	11	0.19	2.00	6.28	3.9
64	ENT Malignancy	0.28	7	0.07	2.17	6.93	4.3
65	Dysequilibrium	0.14	19	0.03	1.06	3.63	5.3
66	Epistaxis	0.34	16	0.06	1.34	4.19	5.2
67	Epiglottitis	0.62	3	0.09	1.23	4.91	7.3
68	Otitis Med+Uri 69+ A/O CC	0.33	24	0.05	1.39	4.27	7.1
69	Otiti Med+Uri 18-69 WO CC	0.30	10	0.08	1.10	3.60	4.0
70	Otitis Med+Uri 0-17	0.52	59	0.13	2.35	6.61	4.0
71	Laryngotracheitis	0.66	34	0.24	3.01	9.68	2.8
72	Nasal Trauma+Deform	0.52	2	0.15	1.43	4.57	3.5
73	Oth ENT Diag 17+	0.39	20	0.13	1.49	4.69	3.1
74	Oth ENT Diag 0-17	0.31	11	0.09	2.30	8.58	3.6
75	Maj Chest Proc	2.44	33	0.22	1.55	5.45	10.9
76	Oth Resp Sys OR Proc w CC	0.86	3	0.11	1.71	5.92	8.0
77	Oth Res Sys OR Proc wo CC	1.00	5	0.17	1.70	5.57	6.0
78	Pulmon Embolism	0.91	13	0.08	1.33	4.27	11.3
79	Res Infec+Inflam 69+A/OCC	1.41	11	0.08	1.96	16.66	16.7

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
80	Res Infec+Inflam 18-69	1.44	4	0.10	0.62	1.84	13.8
81	Res Infec+Inflam 0-17	0.87	6	0.07	2.13	8.41	12.7
82	Resp Neoplasms	0.42	53	0.04	1.43	4.60	10.7
83	Maj Chest Trau 69+ A/O CC	0.42	2	0.05	1.24	4.65	8.5
84	Maj Chest Trau 70- W/O CC	0.59	1	0.20	1.33	3.67	3.0
85	Pleural Effus 69+ A/O CC	0.00	2	0.00	2.25	6.30	10.0
87	Pulmon Edema+Resp Fail	1.21	6	0.10	2.70	10.03	12.7
88	Chron Obstruc Pulmon Dis	0.80	47	0.07	1.69	5.41	11.5
89	Simp Pneu+Pleur 69+A/O CC	0.59	61	0.07	1.66	5.46	8.6
90	Simp Pneu+Pleur 18-69	0.69	28	0.16	1.27	3.81	4.4
91	Simp Pneu+Pleur 0-17	0.79	82	0.13	2.44	8.37	6.1
92	Inter Lung Dis 70- W/O CC	0.93	6	0.10	1.24	3.95	9.2
94	Pneumothorax 69+ A/O CC	0.78	5	0.07	0.96	4.00	10.6
95	Pneumothorax 70- W/O CC	0.69	14	0.14	1.51	4.57	5.0
96	Bronch+Asthma 69+ A/O CC	0.49	40	0.08	1.51	4.71	6.5
97	Bronch+Ast 18-69 W/O CC	0.52	45	0.10	1.50	4.85	5.2
98	Bronch+Asthma 0-17	0.72	178	0.13	2.47	9.03	5.4
99	Resp Sign+Symp 69+ A/O CC	0.58	14	0.07	2.63	9.30	8.2
100	Resp Sign+Symp 70- W/O CC	0.45	25	0.07	2.27	8.03	6.3
101	Oth Resp Sys Diag 69+	0.54	22	0.08	2.06	7.08	7.0
102	Oth Resp Sys Diag 70-	0.59	7	0.08	1.39	5.22	7.7
104	CardValvProc w Pump/CCath	7.32	2	0.56	2.04	7.96	13.0
105	CardValvProc w Pump,wo CC	6.34	17	0.56	2.57	11.57	11.3
106	Coron Bypass w Card Cath	5.33	5	0.22	2.64	10.73	24.0
107	Coron Bypass w/o Car Cath	4.66	31	0.38	2.56	10.36	12.4
108	Oth CarorThor Proc w Pump	4.78	8	0.50	3.49	15.12	9.6
109	CardioThor Proc w/o Pump	4.36	13	0.60	4.17	17.27	7.2
110	Maj Rec Vas ProcwoPump69+	2.16	23	0.15	1.53	5.89	14.3
111	Maj Rec Vas Prow/oPum 70-	2.45	4	0.20	1.33	4.73	12.0
112	VascProc x Maj Recw/oPump	1.77	56	0.23	2.12	7.87	7.7
113	AmpCircSysDis x UppLim+To	1.69	3	0.06	1.57	5.07	27.3
115	PermCarPace Impl w A,HF,S	3.13	4	0.12	1.69	6.45	26.0
116	PermCarPace Imp wo A,HF,S	1.59	30	0.18	1.72	6.49	8.6
117	CardPace Repl+Rev Exc Pul	0.65	2	0.14	2.22	8.11	4.5
118	Card Pace Pulse Gen Rep	1.92	2	0.19	2.65	10.55	10.0
119	Vein Ligation+Strip	0.66	25	0.13	1.22	3.82	5.0
120	Oth Circ Sys OR Proc	1.51	3	0.27	1.65	5.65	5.7
121	Cir Disor w Ami+C.V,Alive	0.94	47	0.07	1.79	7.25	13.8
122	Cir Disor w Ami+C.V,Alive	0.94	58	0.10	1.78	6.67	9.0
123	Clr Disor w Ami, Expired	0.92	22	0.15	3.90	15.18	6.2

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
124	Cir Dis x Ami w CarCath	0.63	32	0.08	1.93	7.40	8.0
125	Cir Dis x Ami w CarCathCD	0.26	174	0.07	1.79	6.55	3.6
126	Acut+Subacut Endocard	2.98	3	0.09	2.13	7.47	32.0
127	Heart Fail +Shok	0.61	89	0.06	1.45	4.77	9.9
128	Deep Vein Thrombophl	0.72	7	0.08	0.80	2.79	9.4
129	Card Arrest, Unexpl	1.72	1	1.72	10.00	9.00	1.0
130	Perip Vasc Dis 69+ A/O CC	0.54	41	0.07	1.68	5.43	7.8
131	Perip Vasc Dis 70- w/o CC	0.48	14	0.08	1.29	4.10	6.1
132	Atherscler 69+ A/O CC	0.75	14	0.11	1.58	5.26	6.9
133	Atheroscler 70- w/o CC	0.70	10	0.18	2.23	7.75	4.0
134	Hypertension	0.36	7	0.07	0.85	2.74	4.9
135	Car Con+Val Dis69+ A/O CC	0.89	1	0.03	2.41	8.45	29.0
136	Car Con+Val Dis 18-69	0.75	3	0.32	1.86	6.00	2.3
137	Car Con+Val Disor 0-17	0.63	9	0.24	3.38	13.21	2.7
138	Car Arr+Cond Dis 69+a/oCC	0.49	43	0.07	1.69	6.35	6.9
139	Car Arr+Cond Dis 70-w/oCC	0.28	21	0.10	1.93	7.17	2.9
140	Angina Pectoris	0.33	50	0.05	2.03	6.45	6.2
141	Syncope+Coll 69+ a/o CC	0.34	22	0.06	1.39	4.25	5.6
142	Syncope+Coll 70- w/o CC	0.29	13	0.06	1.08	3.65	4.8
143	Chest Pain	0.26	70	0.07	1.62	5.80	3.8
144	Oth Cir Sys Diag w CC	0.53	23	0.07	1.56	5.73	8.0
145	Oth Cir Sys Diag w/o CC	0.68	10	0.09	2.79	10.23	7.7
146	Rectal Resec 69+ a/o CC	1.64	15	0.11	1.59	5.13	15.4
147	Rectal Resec 70- w/o CC	0.76	3	0.07	1.22	3.75	10.7
148	MajSm+LgBowelProc69+a/oC	1.90	51	0.10	1.68	5.77	18.3
149	MajSm+LgBowelProc70-w/oC	1.52	18	0.14	1.61	5.17	10.6
150	Perit Adhesio 69+ a/o CC	1.56	6	0.18	1.73	5.53	8.5
151	Perit Adhesio 70- w/o CC	1.11	10	0.17	1.62	4.65	6.5
152	MinSm+LgBowelProc69+a/oC	1.00	21	0.11	1.59	5.30	9.3
153	MinSm+LgBowelProc70-w/oC	1.02	14	0.12	1.14	3.58	8.6
154	Sto,Eso,+DuoProc69+ a/oCC	1.96	52	0.17	1.51	5.11	11.3
155	Sto,Eso+DuoProc18-69w/oC(	1.40	23	0.19	1.45	4.69	7.4
156	Sto,Eso+Duo Proc 0-17	0.70	6	0.13	1.79	6.27	5.5
157	Anal+StomalProc 69+ a/oCC	0.60	33	0.08	1.10	3.44	7.6
158	Anal+StomalProc 70- w/oCC	0.43	69	0.10	1.23	3.67	4.4
159	HernPro x Ing+Fem69+a/oCC	0.31	16	0.04	1.20	3.93	7.9
160	Hern Proc x Ing+Fem 18-69	0.72	25	0.15	1.33	4.21	4.7
161	Ing+Fem HernProc 69+a/oCC	0.43	38	0.07	1.34	4.19	6.4
162	Ing+Fem HernProc 18-69	0.33	79	0.09	1.25	3.81	3.6
163	Hernia Proc 0-17	0.90	16	0.41	2.29	7.57	2.2

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
164	App w ComPrinDiag69+a/oCC	0.59	7	0.08	1.27	4.19	7.4
165	App w ComPrinDiag70-w/oCC	0.63	16	0.10	1.17	3.76	6.4
166	App w/o ComPriDia69+a/oCC	1.09	5	0.20	1.59	4.89	5.4
167	App w/o ComPriDia70-w/oCC	0.67	78	0.18	1.50	4.73	3.7
168	Mouth Proc 69+ a/o CC	0.66	21	0.09	1.61	5.59	6.9
169	Mouth Proc 70- w/o CC	0.35	32	0.12	1.67	4.86	3.0
170	Oth Dig Sys Proc 69+a/oCC	2.26	11	0.26	2.15	6.95	8.7
171	Oth Dig Sys Proc 70-w/oCC	1.61	13	0.20	1.27	4.45	7.9
172	Diges Malig 69+ a/o CC	0.57	15	0.09	1.79	5.82	6.1
173	Diges Malig 70- w/o CC	0.00	2	0.00	1.40	3.80	5.0
174	G.I Hemor 69+ a/o CC	0.68	43	0.10	1.37	4.26	7.1
175	G.I Hemor 70- w/o CC	0.32	11	0.14	1.31	3.96	2.4
176	Complic Peptic Ulcer	0.62	3	0.07	0.96	3.11	9.3
177	Uncom Pep Ulcer 69+ a/oCC	0.66	5	0.08	1.44	4.66	8.2
178	Uncom Pep Ulcer 70- w/oCC	0.56	7	0.11	0.83	2.49	5.0
179	Inflamm Bowel Dis	0.67	47	0.09	1.09	3.42	7.1
180	G.I Obstruc 69+ a/o CC	0.57	12	0.10	1.81	5.67	5.8
181	G.I Obstruc 70- w/o CC	0.29	12	0.07	0.98	2.75	4.3
182	Eso,Gas+Misc Dig 69+a/oCC	0.36	122	0.05	1.52	5.19	6.5
183	Eso,Gas+Misc Dig 18-69	0.31	134	0.06	1.08	3.57	4.8
184	Eso,Gas+Misc Dig 0-17	0.46	128	0.13	2.06	6.65	3.6
185	Den+Oral Dis x Ext+Res17+	0.58	26	0.25	1.70	5.13	2.3
186	Den+Ora Dis x Ext+Res0-17	0.36	8	0.14	2.62	9.52	2.6
187	Dental Extrac+Restor	0.38	28	0.15	2.15	6.31	2.4
188	Oth Dig Sys Diag 69+a/oCC	0.45	24	0.06	1.21	3.82	7.0
189	Oth Dig Sys Diag 18-69	0.38	11	0.07	1.11	2.98	5.2
190	Oth Dig Sys Diag 0-17	0.92	12	0.33	2.24	7.30	2.8
191	Maj Pan,Liver+Shunt Proc	1.98	9	0.12	1.60	5.88	16.1
192	Min Pan,Liver+Shunt Proc	2.43	5	0.13	1.25	4.64	18.4
193	BilTraProXTotChol69+a/oCC	1.20	14	0.17	1.72	5.29	7.0
194	BilTraProXTotChol70-w/oCC	0.80	8	0.11	1.00	3.16	7.0
195	Tot Chol w CDE 69+ a/o CC	1.51	24	0.13	1.53	4.98	11.7
197	Tot Chol w/o CDE 69+a/oCC	1.35	100	0.16	1.51	4.87	8.4
198	Tot Chol w/o CDE 70-w/oCC	0.72	89	0.11	1.35	4.25	6.4
199	Hepat Diag Proc for Malig	2.34	1	0.13	1.22	3.94	18.0
200	Hepat Diag Proc Non-Malig	1.31	2	0.19	1.93	6.57	7.0
201	Oth Hepat or Pan OR Proc	1.94	7	0.20	1.49	4.60	9.7
202	Cirr + Alcohol Hepatit	0.54	13	0.05	1.31	3.86	10.9
203	Malig Hepat Sys or Pan	0.33	19	0.03	2.26	7.30	9.7
204	Disord of Pan x Malig	0.69	28	0.08	1.34	4.14	9.0

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
205	LivXMaligCirAlcHep69+aoCC	0.92	7	0.18	1.51	4.94	5.0
206	LivXMaligCirAlcHep70-woCC	0.48	8	0.09	1.23	3.70	5.4
207	Disor Bil Tract 69+ a/oCC	0.47	5	0.04	1.53	4.95	11.0
208	Disor Bil Tract 70- w/oCC	0.75	7	0.26	1.10	3.35	2.9
209	Maj Jnt+Limb Reatt Proc	1.49	45	0.11	1.34	4.22	13.6
210	Hip+FemProcXMajJnt69+aoCC	1.41	18	0.08	1.61	4.74	17.7
211	Hip+FemProcXMajJnt18-69	1.03	19	0.11	1.26	3.89	9.8
212	Hip+FemProcXMaj Jnt 0-17	1.25	4	0.16	1.81	6.39	7.8
213	AmpFor Mus Sys+ConTis Dis	1.98	2	0.49	1.88	6.00	4.0
214	Back+Neck Proc 69+ a/o CC	0.90	27	0.08	1.30	4.33	11.9
215	Back+Neck Proc 70- w/o CC	0.70	82	0.09	1.18	3.77	8.1
216	Biop Muscul Sys+Conn Tiss	1.09	10	0.12	1.28	4.21	9.0
217	WNDDeb+SknGrftXMus+ConTis	1.73	12	0.15	1.69	4.59	11.5
218	LExtr+HumProcXHipFtFem69+	0.95	16	0.14	1.46	4.39	6.7
219	LExtr+HumProcXHiFtFe18-69	0.70	60	0.13	1.34	4.01	5.5
220	LExtr+HumProcXHiFtFe0-17	0.86	14	0.26	1.96	7.22	3.3
221	Knee Proc 69+ a/o CC	0.83	11	0.13	1.47	5.12	6.2
222	Knee Proc 70- w/o CC	0.53	99	0.14	1.72	5.20	3.8
223	Maj Sh/Elb Proc or OthwCC	0.56	11	0.18	1.60	5.00	3.2
224	Sh,Elb,ForProc XMajJtProc	0.41	68	0.13	1.57	5.23	3.1
225	Foot Proc	0.44	68	0.10	1.46	4.67	4.3
226	Soft Tis Proc 69+ a/o CC	0.59	9	0.06	1.05	3.32	10.2
227	Soft Tis Proc 70- w/o CC	0.42	41	0.13	1.51	5.01	3.2
228	Maj Th/Jnt Proc,Oth w CC	0.52	14	0.28	2.35	6.58	1.9
229	Han/WrstProcXMajJntw/oCC	0.38	52	0.14	1.86	5.96	2.7
230	Loc Exc+Rem InDev Hip+Fem	0.68	9	0.18	1.53	5.50	3.8
231	Loc Exc+Rem InDevXHip+Fem	0.51	35	0.15	1.68	5.28	3.3
232	Arthroscopy	0.62	24	0.33	2.62	8.51	1.9
233	Ot Mus Sys+Con Tis OR 69+	1.39	4	0.22	1.28	4.32	6.3
234	Ot Mus Sys+Con Tis OR 70-	0.74	41	0.19	1.96	6.42	3.9
235	Frac of Femur	0.81	7	0.05	2.16	7.65	15.7
236	Frac of Hip+Pelvis	0.77	14	0.07	1.55	4.90	10.9
237	Spr,Str+Dislo Hip,Pel,Thi	0.40	3	0.13	1.00	2.33	3.0
238	Osteomyelitis	0.00	1	0.00	1.17	3.67	42.0
239	Path Frac+Mus+Con Tis Mal	0.20	14	0.02	0.93	2.73	12.5
240	Con Tis Disor 69+ a/o CC	0.45	20	0.04	1.09	3.61	11.1
241	Con Tis DIsor 70- w/o CC	0.68	23	0.07	1.08	3.48	9.5
242	Septic Arthritis	0.73	2	0.05	2.30	9.52	13.5
243	Medic Back Problems	0.36	131	0.07	1.20	3.52	5.2
244	BoneDis+Spec Arth69+a/oCC	0.34	8	0.04	0.92	3.45	7.5

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
245	BoneDis+Spec Arth70-w/oCC	0.38	10	0.06	0.80	2.39	6.1
246	Non-Spec Arthropathies	0.30	4	0.03	1.15	3.59	8.5
247	S+S Mus Sys+Con Tis	0.54	16	0.14	1.32	4.39	3.9
248	Tend,Myos+Bursitis	0.36	18	0.07	1.15	3.65	4.9
249	Aftercare, MusSys+Con Tis	0.63	10	0.14	1.13	3.20	4.5
250	Fra,Spr,Str+Dis/Han,Ft69+	0.43	6	0.08	1.18	3.79	5.5
251	Fr,Spr,Str+Dis/Ha,Ft18-69	0.33	16	0.10	1.56	4.69	3.3
252	Fr,Spr,Str+Dis/Ha,Ft0-17	0.26	4	0.26	3.50	7.50	1.0
253	Fr,Sp,Str+Dis/UA,LLXFt69+	0.26	12	0.03	1.30	3.82	8.6
254	Fr,Sp,Str+Dis/UA,LL18-69	0.27	33	0.09	1.44	4.31	2.9
255	Fr,Sp,Str+Dis/UA,LL0-17	0.46	15	0.18	2.63	9.13	2.5
256	Oth Diag Mus Sys+Con Tis	0.58	12	0.10	1.78	6.88	5.7
257	Tot Mast Malig 69+ a/o CC	0.80	12	0.09	1.21	3.97	8.8
258	Tot Mast Malig 70- w/o CC	0.85	8	0.08	1.47	4.74	10.9
259	SbTot Mas Mali 69+ a/o CC	0.38	9	0.07	1.48	4.15	5.1
260	SbTot Mas Mali 70- w/o CC	0.33	10	0.06	1.05	3.26	5.7
261	Br Proc NMal X Bi+Loc Exc	0.38	56	0.14	1.54	5.08	2.8
262	Br Biop+Loc Exc NMalig	0.26	30	0.11	1.72	5.10	2.4
263	SkGrfta/oDebUlc/Cell69+	1.21	4	0.07	1.72	5.65	17.0
264	SkGrfta/oDebUlc/Cell70-	0.00	1	0.00	0.58	2.49	43.0
265	SkGrfta/oDebXSkUlc/CelwCC	0.40	7	0.04	1.58	5.53	10.4
266	SkGrfta/oDebXSkUlc/Cell	0.41	16	0.09	1.44	5.08	4.7
267	Perianal+Pilon Proc	0.45	10	0.13	1.53	4.71	3.4
268	Sk,Sbcut Tis+Br Plas Proc	0.07	16	0.02	1.23	4.60	3.0
269	OtSk,SbcutTis+BrOR 69+ CC	0.71	8	0.13	1.78	6.67	5.6
270	OtSk,SbcutTis+BrOR 70-	0.60	32	0.21	1.64	5.48	2.9
271	Skin Ulcers	0.63	2	0.04	1.13	4.33	15.0
272	Maj Sk Disord 69+ a/o CC	0.85	4	0.08	1.91	6.33	11.3
273	Maj Sk Disord 70- w/o CC	0.66	6	0.08	1.83	7.21	8.8
274	Malig Br Disor 69+ a/o CC	1.04	3	0.16	1.70	4.90	6.7
276	NonMalig Br Disord	0.57	3	0.17	1.90	5.20	3.3
277	Cellulit 69+ a/o CC	0.89	6	0.11	1.78	5.69	8.2
278	Cellulit 18-69 w/o CC	0.45	15	0.07	1.31	4.05	6.9
279	Cellulit 0-17	0.47	12	0.06	2.32	8.04	7.7
280	Tr Sk,SbcutTis+Br69+a/oCC	0.34	24	0.05	1.85	6.04	6.9
281	Tr Sk,SbcutTis+Br 18-69	0.38	7	0.11	1.83	5.88	3.4
282	Tr Sk,Sbcut Tis+Br 0-17	0.34	4	0.17	2.63	7.75	2.0
283	Min Sk Disord 69+ a/o CC	0.51	5	0.07	1.91	6.74	7.0
284	Min Sk Disord 70- w/o CC	0.48	13	0.16	1.26	3.76	2.9
286	Adrenal+Pit Proc	1.34	10	0.15	1.37	10.22	9.1

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
287	SkGft+WndDebEn,Nut+MetDis	2.38	1	0.20	1.33	4.00	12.0
288	OR Proc Obesity	1.46	29	0.22	2.08	6.77	6.6
289	Parathyroid Proc	0.13	10	0.02	1.19	3.19	6.2
290	Thyroid Proc	0.49	28	0.10	1.53	4.90	4.8
291	Ot En,Nu+Me OR Proc 69+	0.40	3	0.09	1.54	4.85	4.3
293	Ot En,Nu+Me OR Proc 70-	1.80	2	0.90	2.00	8.00	2.0
294	Diabetes 35+	0.55	30	0.08	1.04	3.19	7.2
295	Diabetes 0-35	0.59	16	0.10	1.21	3.67	6.2
296	Nut+Misc Met Diso69+a/oCC	0.56	25	0.08	1.40	4.34	7.0
297	Nut+Misc Met Disor 18-69	0.54	13	0.10	1.62	5.25	5.3
298	Nut+Misc Met Disor 0-17	0.72	35	0.09	1.99	7.71	8.1
299	Inborn Errors Metab	0.80	3	0.08	2.38	9.00	9.7
300	Endocrine Disor 69+ a/oCC	0.67	7	0.08	1.48	5.21	8.0
301	Endocrine Disor 70- w/oCC	0.55	15	0.14	1.03	3.39	3.9
302	Kidney Transplant	4.63	8	0.24	2.03	6.41	19.4
303	Kid,Ure+Maj Bla Proc Neop	2.21	10	0.15	1.33	5.14	14.5
304	Kid,Ure+Maj Bla ProcNM69+	1.45	28	0.14	1.48	5.15	10.6
305	Kid,Ure+Maj Bla ProcNM70-	1.14	34	0.12	1.26	4.17	9.2
306	Prostatectomy 69+ a/o CC	0.94	4	0.05	1.13	3.77	17.3
307	Prostatectomy 79- w/o CC	0.96	1	0.16	1.17	4.00	6.0
308	Min Blad Proc 69+ a/o CC	0.77	6	0.13	1.28	4.28	6.0
309	Min Blad Proc 70- w/o CC	0.86	3	0.17	1.60	5.20	5.0
310	TranUreth Proc 69+ a/o CC	0.42	43	0.07	1.20	3.84	6.3
311	TranUreth Proc 70- w/o CC	0.35	46	0.10	1.15	3.69	3.6
312	Urethral Proc 69+ a/o CC	0.55	4	0.07	1.45	4.71	7.8
314	Urethral Proc 0-17	0.43	3	0.09	2.57	9.50	4.7
315	Oth Kid+Urin Trct OR Proc	0.87	16	0.09	1.63	5.26	9.3
316	Renal Failure	0.53	20	0.07	2.48	8.74	7.6
317	Renal Dialysis	0.00	1	0.00	0.87	3.30	23.0
318	Kid+Uri Trc Neo 69+ a/oCC	0.38	12	0.04	1.22	4.02	8.9
319	Kid+Uri Trc Neo 70- w/oCC	0.37	2	0.15	1.00	2.80	2.5
320	Kid+Uri Trc Inf 69+ a/oCC	0.51	32	0.07	1.34	4.03	7.6
321	Kid+Uri Trc Infec 18-69	0.36	19	0.08	1.55	4.82	4.3
322	Kid+Uri Trc Infec 0-17	0.67	23	0.14	1.97	6.80	4.8
323	Urin Stones 69+ a/o CC	0.34	24	0.09	1.38	4.71	4.0
324	Urin Stones 70- w/o CC	0.24	42	0.08	1.06	3.28	3.0
325	Kid+Uri Trc S+S 69+ a/oCC	0.18	11	0.05	1.26	4.40	3.8
326	Kid+Uri Trc S+S 18-69	0.34	6	0.17	1.75	5.58	2.0
327	Kid+Uri Trc S+S 0-17	0.55	3	0.18	1.78	7.00	3.0
328	Ureth Stricture 69+ a/oCC	0.00	8	0.00	1.10	3.40	2.5

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
329	Ureth Stricture 18-69	0.49	2	0.49	1.50	6.00	1.0
330	Ureth Stricture 0-17	0.00	1	0.00	1.00	3.50	2.0
331	Ot Kid+Uri Trc Diag 69+	0.28	36	0.04	1.30	4.41	6.8
332	Ot Kid+Uri Trc Diag 18-69	0.45	18	0.12	0.97	3.12	3.8
333	Ot Kid+Uri Trc Diag 0-17	0.79	5	0.40	3.00	9.50	2.0
334	Maj Male Pelvic Proc w CC	1.80	1	0.09	0.85	3.30	20.0
336	TransUre Prost 69+ a/o CC	0.70	102	0.08	1.15	3.80	9.3
337	Trans URe Prost 70-w/o CC	0.57	48	0.09	1.13	3.69	6.6
338	Testes Proc Malig	0.30	6	0.06	1.10	3.53	5.0
339	Testes Proc NMal 17+	0.27	19	0.07	1.12	3.52	3.8
340	Testes Proc NMal 0-17	0.41	16	0.17	2.26	8.45	2.4
341	Penis Proc	0.70	10	0.09	2.05	6.68	7.5
342	Circumcision 17+	0.00	3	0.00	1.00	3.29	2.3
343	Circumcision 0-17	0.38	3	0.28	2.75	4.75	1.3
345	Ot Male Repro OR ProcXMal	0.00	1	0.00	1.00	2.50	2.0
346	Malig,Male Repro Sys 69+	0.26	10	0.02	1.10	3.52	10.9
347	Malig,Male Repro Sys 70-	0.32	2	0.11	1.17	3.50	3.0
348	Ben Pros Hypert 69+ a/oCC	0.10	12	0.04	1.03	3.00	2.7
349	Ben Pros Hypert 70- w/oCC	0.24	6	0.12	1.25	3.42	2.0
350	Inflamm Male Repro Sys	0.27	7	0.06	1.24	3.62	4.1
352	Ot Male Repro Sys Diag	0.36	3	0.06	1.00	2.59	5.7
353	PelvEvis,RadHysy+RadVulv	0.00	1	0.00	1.58	5.00	12.0
354	Ute,AdnPr NOv/Adn Mal 69+	0.79	12	0.08	1.29	4.55	9.8
355	Ute,AdnPr NOv/Adn Mal 70-	0.91	17	0.12	1.24	4.24	7.8
356	Fem Repro Sys Recon Proc	0.70	47	0.06	1.21	4.24	11.1
357	Ut+Adn Proc Ova/Adn Malig	0.53	4	0.05	1.38	4.28	10.0
358	Ut+Adn Proc NMalig 69+	0.81	83	0.11	1.22	4.29	7.6
359	Ut+Adn Proc NMalig 70-	0.77	273	0.13	1.22	4.51	6.1
360	Vag,Cerv+Vulv Proc	0.39	49	0.16	1.58	5.06	2.5
361	Lapar+Inc Tubal Interr	0.61	62	0.26	1.63	5.14	2.3
362	Endoscop Tubal Interr	0.27	13	0.17	1.76	5.43	1.6
363	D+C,Con+Radio Impl Malig	0.44	24	0.19	1.83	6.24	2.3
364	D+C,Coniz X Malig	0.31	62	0.17	1.69	4.99	1.8
365	Ot Female Rep Sys OR Proc	1.91	10	0.13	1.71	6.35	14.3
367	Malig, Fem Repro Sys 70-	0.00	3	0.00	1.33	4.33	2.0
368	Infec, Female Repro Sys	0.56	19	0.15	1.10	3.79	3.7
369	Men+Ot Fem Repr Sys Disor	0.39	38	0.17	1.34	4.60	2.3
370	Cesarean Sec w CC	0.52	93	0.07	0.97	4.27	7.8
371	Cesarean Sec w/o CC	0.60	209	0.09	1.13	4.17	6.4
372	Vag Deliv w Comp Diag	0.42	190	0.08	0.98	3.82	5.1

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
373	Vag Deliv w/o Comp Diag	0.23	1087	0.06	0.89	3.38	4.1
374	Vag Deliv w Ster a/o D+C	0.41	88	0.09	0.89	3.16	4.6
375	VagDel ORProc XStera/oD+C	0.68	1	0.11	0.67	2.00	6.0
376	PostPar+PostAbor w/o OR	0.19	35	0.07	1.12	4.14	3.0
377	PostPar+PostAbor w OR	0.41	17	0.14	1.60	5.20	2.9
378	Ectopic Preg	0.54	45	0.10	1.10	3.82	5.2
379	Threatened Abortion	0.23	52	0.08	1.26	4.44	3.0
380	Abortion w/o D+C	0.24	30	0.12	1.32	4.39	2.0
381	Abor w D+C,Asp Cur,or Hys	0.26	190	0.16	1.56	4.73	1.6
382	False Labor	0.11	23	0.04	1.64	6.00	2.8
383	Ot Antepar Diag w Compl	0.36	178	0.08	1.06	4.19	4.5
384	Ot Antepar Diag w/o Compl	0.29	98	0.10	0.95	3.93	3.0
385	Neonates,Died or Transf	0.32	15	0.13	6.14	22.73	2.5
386	Ex Immat/Resp Dis Syn,Neo	3.06	25	0.13	3.26	12.46	23.0
387	Prematurity w Maj Prob	1.41	57	0.10	2.70	9.92	14.5
388	Prematurity w/o Maj Prob	0.75	57	0.11	1.80	5.50	7.0
389	Full Term Neo w Maj Prob	0.27	272	0.05	1.93	6.05	5.4
390	Neo w Oth Signif Prob	0.26	524	0.06	1.56	4.51	4.1
391	Normal Newborns	0.15	737	0.04	1.52	4.22	3.8
392	Splenectomy 17+	2.78	7	0.35	1.84	6.25	8.0
393	Splenectomy 0-17	1.01	3	0.10	2.03	7.22	10.7
394	Ot ORProc Blood/Blood Org	1.01	14	0.21	1.56	5.40	4.9
395	Red Blood Cell Disord 17+	0.53	19	0.08	1.71	6.01	7.0
396	Red Blood Cell Dis 0-17	0.30	6	0.05	1.59	5.32	5.7
397	Coagulation Disord	0.89	19	0.09	1.50	4.31	9.7
398	Ret+Immun Disor 69+ a/oCC	0.39	5	0.07	1.20	4.27	6.0
399	Ret+Immun Disor 70- w/oCC	0.43	5	0.07	1.03	3.30	6.0
400	Lymp/Leuk w Maj OR Proc	1.78	7	0.17	1.99	7.15	10.7
401	Lymp/NALeu w Ot ORProc CC	1.93	4	0.15	0.92	2.90	13.0
402	Lym/NALeu wOt ORProcw/oC	0.45	7	0.08	1.18	3.43	5.7
403	Lym/NA Leu w CC	0.08	17	0.01	1.68	5.20	8.9
404	Lym/NA Leu w/o CC	0.20	14	0.03	1.20	4.01	6.0
405	Ac Leu w/o Maj ORProc0-17	1.04	1	0.03	2.54	10.10	39.0
406	Mye Dis/Pr Dif Neop OR CC	0.63	4	0.05	1.42	4.94	13.3
407	Mye Dis/Pr DIf Neop OR	1.14	3	0.11	0.90	2.70	10.0
408	Mye Dis/Pr Dif Neop Ot OR	0.29	11	0.04	1.34	4.28	8.1
409	Radiotherapy	0.00	7	0.00	1.27	3.71	11.3
410	Chemotherapy	0.33	45	0.08	2.56	9.68	4.0
413	Ot Mye Dis/Pr Neop 69+	0.49	17	0.05	2.12	6.63	9.6
414	Ot Mye Dis/Pr Neop 70-	0.09	10	0.01	1.26	3.91	6.8

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
415	OR Proc Infec+Paras Dis	1.50	20	0.13	1.28	4.32	11.4
416	Septecemia 17+	0.46	7	0.05	2.10	7.31	10.1
417	Septecemia 0-17	1.15	3	0.38	2.00	7.11	3.0
418	Post OR+Post Traum Infec	0.59	22	0.10	0.94	2.95	5.8
419	Fever Unkn Orig 69+ a/oCC	0.47	8	0.07	1.26	4.26	6.8
420	Fever Unkn Orig 18-69	0.83	1	0.12	1.00	3.00	7.0
421	Viral Illness 17+	0.33	24	0.07	1.71	5.69	4.5
422	Vir Ill+Fev Unk Orig 0-17	0.66	32	0.18	2.30	7.74	3.7
423	Ot Infec+Paras Dis Diag	1.32	4	0.38	1.29	4.43	3.5
424	OR Proc w Prin Dx Men Ill	1.58	7	0.08	1.73	4.42	19.3
425	Ac Adj Re+Distur Psyc Dys	0.44	14	0.05	1.99	6.50	8.5
426	Depress Neuroses	0.56	34	0.04	1.69	4.51	13.7
427	Neuroses x Depressive	0.56	15	0.07	2.49	7.55	8.5
428	Disord Person+Impuls Cont	0.64	16	0.07	2.36	5.87	8.8
429	Org Dist+Mental Retard	0.25	10	0.02	1.79	5.48	11.8
430	Psychoses	0.65	103	0.04	2.51	5.43	17.0
431	Child Mental Disord	0.65	14	0.03	2.80	8.15	18.6
432	Sub Dep w Rehab Therapy	0.52	4	0.09	0.96	2.13	5.8
434	Sub Dep,Rehab Ther+Detox	0.25	14	0.02	1.45	4.09	12.6
435	Alc/Drug dep,abuse, detox or	0.56	34	0.07	1.43	4.41	7.7
439	Skin Grft for Injur	1.65	2	0.10	1.91	6.44	16.0
440	Wound Deb for Injur	0.89	23	0.08	1.43	4.96	10.8
441	Hand Proc for Injur	0.63	7	0.09	2.20	7.10	7.0
442	Ot OR Proc Injur 69+a/oCC	1.18	49	0.16	1.98	6.48	7.3
443	Ot OR Proc Injur 70-w/oCC	1.16	37	0.24	1.64	5.25	4.8
444	Mult Trauma 69+ a/o CC	0.71	6	0.12	1.42	4.11	6.0
445	Mult Trauma 18-69 w/o CC	0.40	12	0.11	1.91	5.80	3.8
446	Mult Trauma 0-17	0.35	11	0.12	1.77	6.19	2.8
448	Allerg Rxs 0-17	0.35	2	0.17	1.25	3.75	2.0
449	Pois+Tox Effec Drugs 69+	0.41	42	0.05	1.81	6.11	7.8
450	Pois+Tox Effec Drugs18-69	0.32	29	0.06	2.14	7.18	5.5
451	Pois+Tox Eff Drugs 0-17	0.49	10	0.14	2.66	8.06	3.5
452	Compl Trmnt 69+ a/o CC	0.48	35	0.07	1.29	4.18	7.1
453	Compl Trmnt 70- w/o CC	0.60	46	0.14	1.66	5.49	4.3
454	Ot Inj,Pois+Tox Ef Dx 69+	0.51	8	0.04	1.35	4.23	12.8
455	Ot Inj,Pois+Tox Ef Dx 70-	0.60	7	0.28	2.40	7.80	2.1
457	Extens Burns w/o OR Proc	3.23	1	3.23	15.00	69.00	1.0
458	N-Extens Burn w Skin Grft	3.25	17	0.24	2.65	10.02	13.7
459	NExt Burn w Wnd Deb+Ot OR	0.00	1	0.00	1.57	4.14	7.0
460	N-Exten Burn w/o OR	1.01	16	0.13	2.60	10.11	7.7

DRG	DESCRIPTION	DRGW	SEP	DRGW/DAY	WLI/D	NH/D	ALOS
461	OR Proc w Diag of Ot Cont	0.62	37	0.09	1.12	3.65	6.7
462	Rehabilitation	0.00	1	0.00	0.46	1.23	13.0
463	S+S w CC	0.16	5	0.01	1.27	4.08	17.0
464	S+S w/o CC	0.46	3	0.23	1.67	5.50	2.0
465	Af Care w Malig as Sec Dx	0.02	17	0.01	1.68	8.09	1.3
466	Af Care w/o Mal as Sec Dx	0.39	18	0.10	2.90	10.39	3.9
467	Ot Fact Infl Health Stat	0.62	48	0.13	1.38	4.70	4.9
468	Unrelated OR Proc	1.78	128	0.20	1.65	5.66	8.8
471	Bil/Mult Maj Jt Proc LExt	1.23	3	0.04	1.67	5.28	34.3
472	Extens Burn w OR Proc	0.00	1	0.00	2.62	12.05	39.0
473	Ac Leu s/o Maj OR Proc17+	1.40	5	0.13	1.77	5.49	10.6